THE THYRIDIDAE (LEPIDOPTERA) OF AFRICA AND ITS ISLANDS

A TAXONOMIC AND ZOOGEOGRAPHIC STUDY

P. E. S. WHALLEY

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ENTOMOLOGY Supplement 17
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BY

PAUL ERNEST SUTTON WHALLEY

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CONTENTS

SYNOPSIS

All the 172 known species and subspecies of Thyrididae (Lepidoptera) from Africa and its islands are dealt with in this work. One hundred and twenty-seven of these species are described and figured, this includes 11 new genera, 56 new species and 10 new subspecies. The remaining 45 species have been dealt with previously (Whalley, 1967, 1968) and are only briefly mentioned here. An account of the morphology, classification and zoogeography of the family is given together with keys to the genera and species and distribution maps of all the species and subspecies.

INTRODUCTION

The present work deals with the 172 species and subspecies of Thyrididae known from Africa and its islands. The expression "Africa and its islands" follows Moreau (1966) and indicates a wider coverage than the current term "Ethiopian Region". The islands include Madagascar, Sokotra, Mascarene, Seychelles and those in the Gulf of Guinea, but not the Cape Verde or Canary Islands.

The species in the Madagascan fauna are included but the information about them is in summary only, since they were more fully dealt with by Whalley, 1967, thus only a new species and additional data are given.

The Thyrididae are a small family which is found primarily in tropical and subtropical regions, only 15 species being known from the Palaearctic Region.

The Thyrididae of the Ethiopian Region have been studied by several authors, some of whom dealt with them as part of a world revision of the family (Pagenstecher, 1892; Hampson, 1897), while others dealt specifically with the species from the Ethiopian Region (Gaede, 1917). In order to identify a collection of Thyrididae from Africa, sent by Dr L. A. Berger, Tervuren, it soon became apparent that the existing literature was not adequate for this.

The first African species was described by Boisduval in 1829, who described it as a species of *Zygaena* and figured it in colour. The collection locality of these early specimens was not known to Boisduval and he suggested that they were from Georgia (U.S.A.). Although the first monograph on the family was by Guenée (1877) he did not include any African species. Walker (1856–69) described a few species and Butler (1879), Plötz (1880), Dewitz (1881) and Saalmüller (1884) all described species of Thyridids from Africa and Madagascar.

The first study of the family as a whole after Guenée was a comprehensive revision by Pagenstecher (1892). This was followed by Hampson (1897) who catalogued the whole family and described new species. The "Lepidopterorum Catalogus" by Dalle Torre (1914) summarizes the information to that date.

The first African study was by Gaede (1917) who gave a detailed account of the specimens in the collection of the Zoological Museum, Berlin. Subsequently (1929) he expanded this study in a volume of Seitz's "Die Gross-Schmetterlinge der Erde". After this, few species were described until papers by Viette (1954 et seq.) and Whalley (1967 and 1968) on African and Madagascan species.

The type-specimens of all species have been examined and dissected and specimens have been borrowed from many Institutions (see Acknowledgements). Lectotypes and neotypes have been designated where necessary and an account is given of the morphology, classification and geographical distribution of all the species. Although the Madagascan species are referred to in this work and included on the maps, the figures in Whalley, 1967, are not repeated here. Similarly, the recently revised African species of *Dysodia*, (Whalley, 1968, figs and text), although included on the maps, are only summarized in the present work.

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MORPHOLOGY OF THE THYRIDIDAE

In the following section the condition of certain morphological characters found in most species in the family is compared with the various modifications found in other species in the family. At the end of the section the diagnostic characters of the family are given.

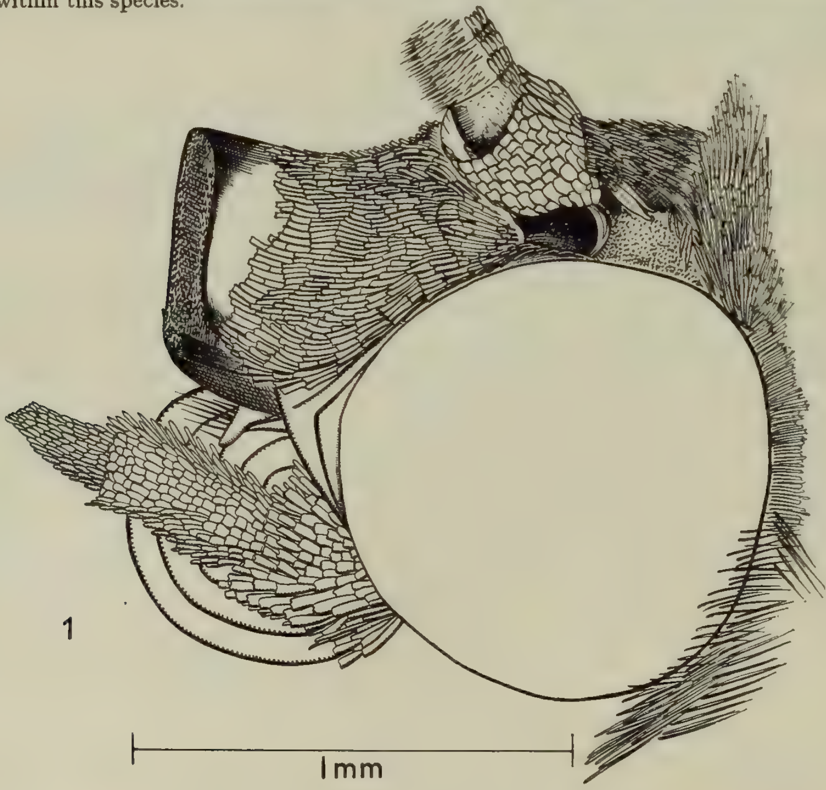
Head (Text-figs 1–3; Pl. 24, figs 127–129). Modifications of the frons are found in very few species and these modifications are mostly small compared with those occurring in other families of Lepidoptera. In some species of *Chrysotypus* the frons is bulbous, projecting slightly between the eyes. This condition is found in a few other genera but only *N. fuliginea* (Text-fig. 1; Pl. 24, figs 127, 129) has a prominent process on the frons, as for example in the Phycitinae (Whalley, 1966 : 272). In species of the genus *Mathoris* the fronto-clypeal region is short and the proboscis arises anteriorly on the head, instead of in the more usual antero-ventral position. This anterior origin of the proboscis is also found in *Sinecalca insolita* (p. 173) where the fronto-clypeal region is short and narrow and the eyes practically meet in the mid-line, being separated only by the small plate bearing the reduced proboscis. In all species, except *Mathoris magica* (Text-fig. 3), the eyes are approximately round when viewed laterally. In *M. magica* the eyes are posteriorly truncate, or slightly reniform when viewed laterally. In some species of *Striglina*, interfacetal hairs (Pl. 24, fig. 130) are present between the ommatidia of the eyes but these hairs are not found in species in other genera of African Thyrididae. The proboscis is not scaled but no detailed study of its structure was made, although the presence or

absence of the proboscis was noted. In the species of *Chrysotypus* the proboscis is often reduced to two small lobes. In all species the maxillary palps, which are minute, are never visible through the scale covering. In some species (e.g. *C. dawsoni*) minute mandibular lobes are visible when the head is de-scaled. The pilifers are present in some species (*D. intermedia*) but absent in others (*C. dawsoni*).[1] Labial palps are usually three-segmented but in *Cecidothyris* all the species have the second and third segments fused to give a two-segmented labial palp. The palps are normally densely covered with scales (Text-figs 1–3).

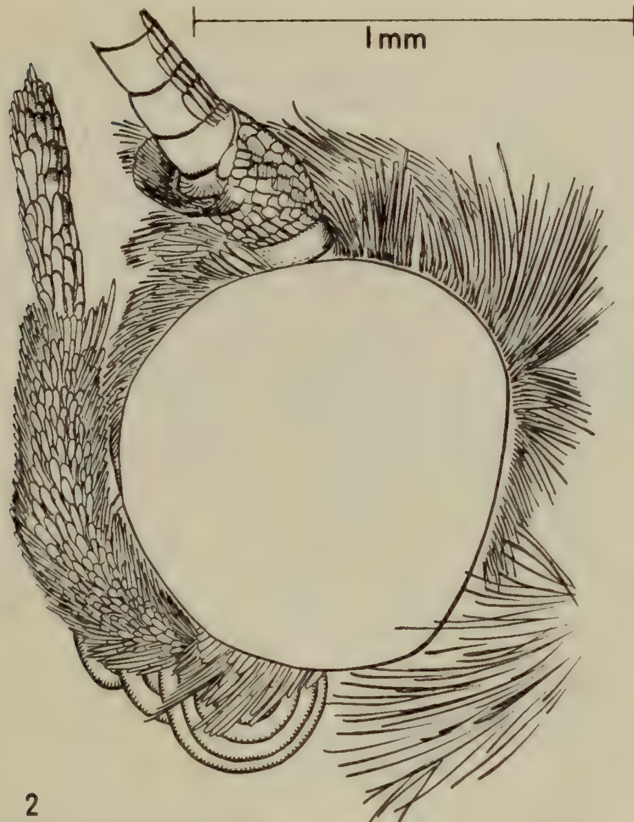
The antennae of the African species of Thyrididae show less variation in shape than in many other families of Lepidoptera. In the majority of species the antennae are minutely ciliate, but ciliate, dentate and pectinate antennae also occur. Detailed stereoscan electron microscope studies of the antennae are in progress, and preliminary results show various types of sense organs, some of which are shown in Pl. 25, figs 131–133. In *R. serraticornis* there are two different lengths of pectinations in the males (p. 94). The chaetosema is absent in all species and ocelli are usually absent. In *Striglina*, ocelli occur in some species but these are mostly very small.

THORAX. No detailed study of the sclerites of the thorax was made. In *Dysodia* the patagia are greatly enlarged and give the species a characteristic appearance

[1] Subsequently some specimens have been found with pilifers present. It appears to be a variable character within this species.



FIGS 1–3. Lateral views of heads. 1. *Neobanisia fuliginea* sp. n.; 2. *Opula perigrapha* Hampson; 3. *Mathoris magica* Gaede.



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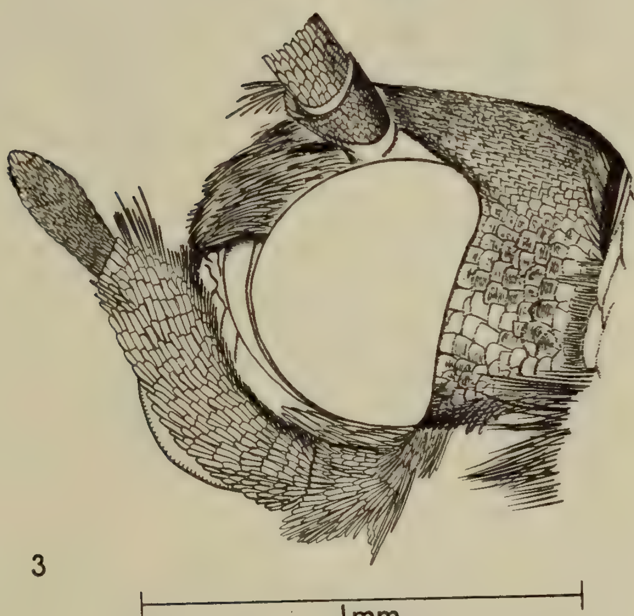

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(Pl. 23, fig. 124). Tegulae are variously developed but rarely long. Certain characters on the legs are used in comparing the species. On the fore leg an epiphysis ("tibial strigal", Pl. 68, fig. 445) is present in all genera except *Sinecalca*. The hind leg was examined for the presence of tibial spurs and tarsal spines. Generally there are two pairs of spurs on the hind tibia, a proximal and distal pair. While the distal pair are always present, with some variation in their lengths, the proximal pair are often modified or absent. These proximal spurs are absent in species of *Chrysotypus*, very reduced in *E. radiata*, one proximal spur is absent in *E. danista* and one proximal spur is absent while the remaining one is elongate and slightly clavate in species of *Collinsa*. The hind tibiae, particularly in species of *Striglina*, have large scale patches on them. The tarsal segments vary in length and this is often of generic significance but the presence or absence of spines is the main character on which separation of some genera is made. The tarsal segments may be without spines or have spines arranged in different groupings (Text-figs 4–6; Pl. 25, fig. 134). The two main groupings of spines on the tarsal segments are

FIGS 4–6. Hind legs. 4. *Chrysotypus circumfuscus* sp. n.; 5. *Banisia apicale* (Fryer); 6. *Dysodia binoculata* Hampson.

(*a*) one pair of spines at the distal end of each tarsal segment and (*b*) rows of spines on each tarsal segment. Some variations from these two groupings occurred, a few species had spines on the last hind tarsal segment only, while others had some extra spines on one or two segments, occasionally only one spine was present on each tarsal segment. The spines, particularly the apical pair, cannot always be seen through the scales on the legs. In all cases where the spines could not be seen through the scales, preparations of the legs were made to check if the spines were concealed. An interesting character which was not studied in detail was the shape of the claw at the end of each leg. The differences in the shape of this claw may be specific (*C. parobifera*) or generic (*Striglina*). In one species (*C. parobifera*) each claw was bifid (Pl. 68, fig. 446), in all others the claws were single on either side of the pulvillus. The bifid tarsal claw is common in many butterfly families but has so far only been found in this one species of Thyrididae.

WINGS. The wing pattern of most species of Thyrididae is a reticulate one, modified in various ways. Rarely this pattern is completely absent (*L. misalis*) or highly modified (*E. radiata*). Species in many genera have patches of iridescent scales under the fore wing (e. g. *Cumbaya*, *Kuja*) or have translucent areas (e. g. *Dysodia*, *Banisia*). Strong sexual dimorphism of pattern has been found only in *N. betousalis*. Generally colour variation was fairly limited in the specimens ex-

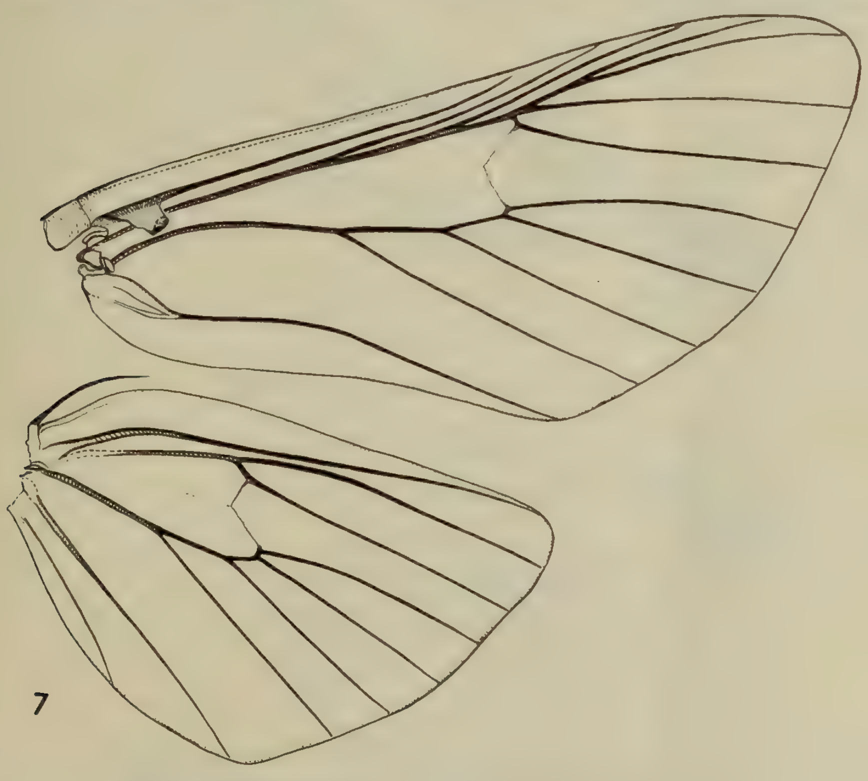

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FIG. 7. Wing venation. 7. *Epaena trijuncta* (Warren).

amined but some extreme cases occurred. In *E. inops* two colour phases were found, a white one with narrow brown reticulations and a brown one with slightly darker brown reticulations. Other aspects of their morphology were similar and some intermediates were found although the two extremes were very different in appearance. The wing venation varies relatively little throughout all African species (Text-figs 7–8). In the fore wing twelve veins (considering $1A$ and $2A$ which are often completely or partially fused, as one vein) are always present with, in some species, fusion near their origin from the cell of radial veins, R_2 to R_5. In only one specimen of one species (*P. stratifica*) was an abnormal condition detected where one fore wing vein was missing from one side. Rarely three of the radials fuse for part of their length (*Epaena*), more frequently only two of them join (*Lelymena, Cumbaya*) but in most genera R_2 to R_5 arise from the cell. There is some variation in the origin of $1A$ and $2A$ and in particular the relative lengths of these veins. In *Lelymena* some variation in the venation occurs in single specimens between the left and right sides but this is exceptional. While there is some intra-specific variation in the origin of R_2 to R_5, in the majority of species the wing venation is constant intra-specifically. The hind wing venation shows little variation

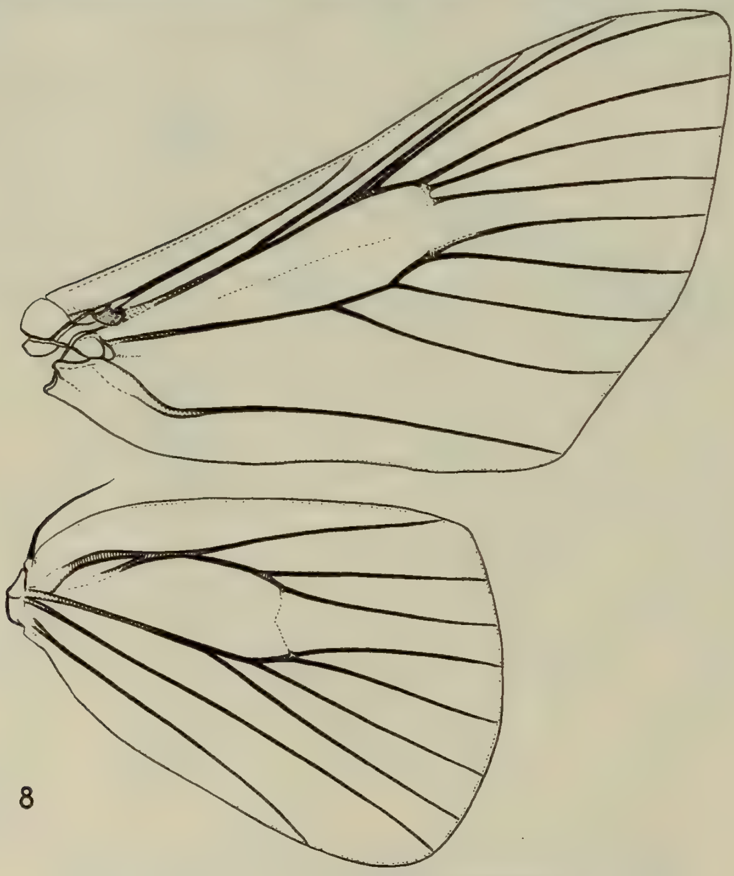
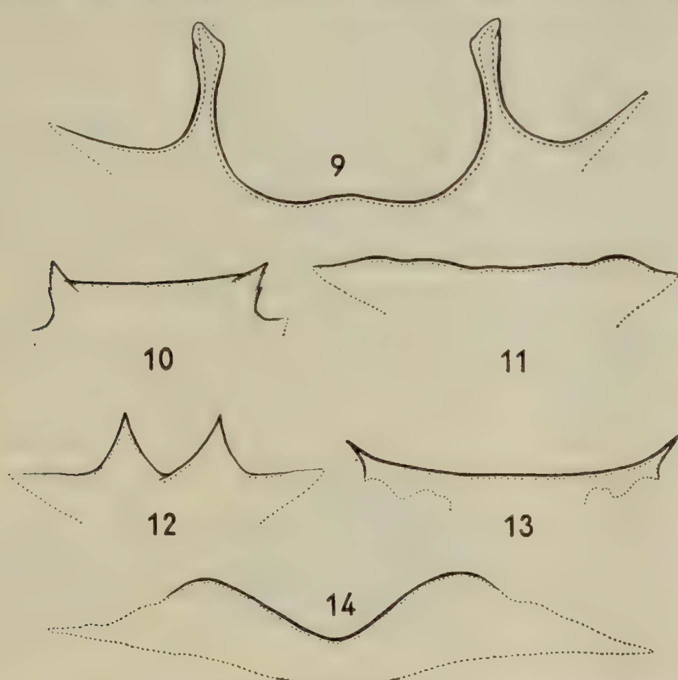


FIG. 8. Wing venation. *Striglina guttistigma* Hampson.

in different species. Two anal veins are invariably present and the main variation found in the hind wings is in the relative positions of $Sc+R_1$ and Rs. In a few species these veins join for a short part of their length, usually about half way along, but they are alway separate at the base and wing margin. In the majority of species these two veins start separately, and while they may approach closely, do not join together. The frenulum hook (retinaculum) under the fore wing is conspicuous in the males as a sclerotized hook and is very prominent in some species. The hook is absent from the females. The males have a single frenulum bristle and the females usually three bristles. In only one genus (*Sinecalca*) is the frenulum absent in both sexes.

ABDOMEN. The abdominal segments present fewer external characters than in some families of Lepidoptera. In some species the pattern is of use for specific determinations and in a few species the sternite of the last abdominal segment of the male is slightly modified (Text-figs 9–14), but these modifications are always slight and never approach those found in some other families, e. g. Drepanidae (Watson, 1965, Wilkinson, 1967). All species are without tympanal organs in the abdomen.

GENITALIA. The genitalia of both sexes show little intra-specific variation and are used to supplement the characters in the external morphology in determining the



FIGS 9–14. Eighth abdominal sternite, ♂. 9. *Striglina eguttalis* Gaede; 10. *Striglina strigifera* Strand; 11. *Striglina ferula* sp. n.; 12. *Striglina trepida* sp. n.; 13. *Striglina augescere* sp. n.; 14. *Striglina guttistigma* Hampson.

relationship of the species. The details of the genitalia will be found under each species examined. The most usual form of the male genitalia is as follows: Uncus a simple, elongate process ("uncus simple" in the key), the tegumen unmodified, the valves simple in outline without extra processes on them other than a small sclerotized process near the base ("median basal process"). The juxta usually has two lateral lobes and often a median plate. The gnathus is a weakly sclerotized loop usually with a small median process. The sacculus is unmodified and the aedeagus is a simple tube without cornuti but with a spiny vesica. Divergence from this basic pattern is greatest in the Striglinae, where many modifications occur. The uncus may be bifid and various reductions of the valves occur in this subfamily. Most of the other subfamilies show smaller modification. The sacculus is modified in *Gnathodes* and a process is present in the middle of the valves ("median process") of the Argyrotypinae. The only modifications of the tegumen occur in *Dysodia* (p. 47), where there is a diverticulum dorsal to the uncus. Various enlargements of the gnathus occur (e. g. *N. nivosa*) or it may be completely lost as in most species of *Chrysotypus*. The transtilla, which is unmodified in most species, is highly modified in species of *Neochrysotypus*. Some variation in the shape of the juxta lobes occurs (e. g. *H. gangaba*) and in many cases the differences in the shape of the juxta are highly specific. In most species the aedeagus is unmodified but in the Argyrotypinae the aedeagus has a prominent lateral process.

There is less variation in the shape of the female genitalia than in the male genitalia. In all species the anal papillae and the apodemes are short and the long extrusible type of ovipositor found in the Galleriinae (Whalley, 1964b) is not found in the African species although in *S. suffusa* the apodemes are proportionally slightly longer than in the other species. In *Chrysotypus* the strongly folded type of anal papilla is unusual and is not found in any other genus except *Lelymena*, and even here the folding is very slight. In most species the surrounds of the ostium ("ostial plate") are unmodified but in *Striglina* heavy sclerotization of the plates round the ostium has taken place. In many species a signum is present, varying from sclerotized plates (*Banisia*) to inward projecting spines (*Hypolamprus*). In the Pachythryinae a secondary sac is present on the bursa (= corpus bursa). Small pores are also present on the eighth segment of the abdomen of species of *Dysodia* similar to those mentioned by Sattler (1967 : 15) in the Ethmiidae, but these have not been noticed in other genera.

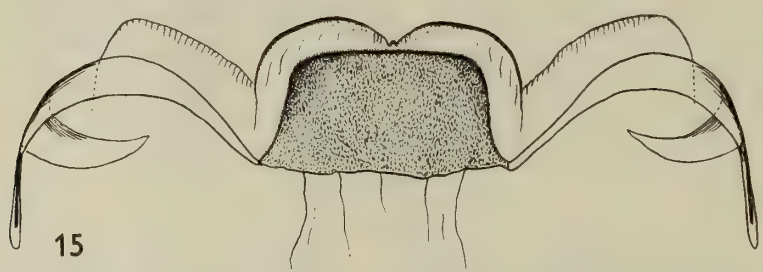


FIG. 15. *Chrysotypus dawsoni* Distant. ♀ Genitalia, detail of ostium.

DESCRIPTION OF THE FAMILY THYRIDIDAE

Proboscis, when present, without scales. Chaetosema absent. Maxillary palps minute, not visible through scale cover. Labial palps usually 3-segmented. Fore wing with twelve veins, without areole. Hind wing with two anal veins. Abdomen without tympanal organ. Frequently brown or yellowish brown species with a strongly reticulate pattern. Hind tibia with at least one pair of apical spurs, frequently with a second pair in median position. Hind wing with $Sc+R_1$ and Rs approaching closely, sometimes joining for part of length.

The family Thyrididae is generally regarded as being in the Pyraloidea (Forbes, 1923; Whalley, 1967) but there are a number of differences from the Pyralidae with which they have been associated (Hampson, 1897). Some of the differences between these families are listed below.

Pyralidae	Thyrididae
Two pairs of palps (usually).	One pair of palps.
Proboscis scaled.	Proboscis without scales.
Ocelli frequently present.	Ocelli usually absent.
Chaetosema often present.	Chaetosema absent.
Tympanal organ in abdomen.	No tympanal organ in abdomen.
Hind wing with 3 anal veins.	Hind wing with 2 anal veins.
Hind wing with $Sc+R_1$ and Rs usually anastomosing.	Hind wing with $Sc+R_1$ and Rs usually free.

The relationship of the Thyrididae to other families in the Lepidoptera is still in dispute, Ragonot (1880) put them as a tribe of the Pyralidae and Hampson (1897) regarded them as Pyraloid. No fossil thyridids are known from Africa and the only described fossil thyridid, *Hexerites primalis* Cockerell (Cockerell, 1933) which, through the kindness of Dr H. Roedeck of the University of Colorado Museum, I have now examined, is almost certainly not a thyridid but is possibly in the Stenomidae. Although retaining the Thyrididae in the Pyraloidea, their exact relationship is not clear and will have to await more detailed work on other lepidopterous families.

BIOLOGY

The Thyrididae are a rather specialized group of primarily dead-leaf mimics, whose pattern is particularly well adapted to the forest habitat. There are, of course, exceptions to this sweeping generalization but broadly speaking this is the appearance that the family presents. This leaf-mimicry reaches its peak in some of the South American species but is well represented in the African fauna.

Early stages. No eggs were available for study. Very little information is available on the host plants of the African Thyrididae. From the data on the specimens, the following species have been reared (but with no further information about the host plant).

K. ansorgei Warren	***Myrica*** sp. (Myricaceae)
S. clathrata	***Coffea*** sp. (Rubiaceae)
R. flavicilia Hampson	Gall-forming on ***Salix woodii*** Seem (Salicaceae), Dept. of Agriculture and Technical Services, Ent. Memoir, Plant Protection Institute, South Africa, 1970.

D. lutescens Whalley	***Ritchiea*** sp. (Capparidaceae). [D. G. Sevastopulo, in litt.]
B. myrsusalis Walker	***Achras*** sp. (Sapotaceae)
C. pexa pexa Hampson	***Terminalia sericea*** Burch. (Combretaceae)
C. pexa guttulata Aurivillius	***Terminalia avicennoides*** Guill. & Perr.
T. ramiculata Warren	***Terminalia ivoriensis*** A. Cheval.
S. rothi Warren	***Terminalia ivoriensis*** A. Cheval.
O. spilotata Warren	***Oryza sativa*** L. (Graminae)

General descriptions of larvae of Thyrididae have been given by Bose (1935) and Beeson (1941) for Oriental species, Heinrich (1920) for some American species and Ufaruna (1968, unpublished) gave information on the biology of one African species (*C. pexa*). The larvae of *C. pexa guttulata* Aurivillius were the only specimens available for examination. They form galls on *Terminalia avicennoides* (Combretaceae) (Pl. 23, fig. 126). The larvae are similar to the general description given by Forbes (1923) of "superficially pyraloid" and with some of the features in Heinrich (1920). The prespiracular plate on the prothorax has two setae (kappa group bisetose, theta absent, Hinton, 1943, nomenclature) and the prolegs have the crochets in circlets, both these characters as in the Pyralidae. The detailed morphology of some of the skin is shown in Pl. 23, fig. 125. Preliminary stereoscan electron microscope studies of the skin of lepidopterous larvae are in progress and have already revealed some interesting structures. Whilst this work is in too early a stage to draw conclusions, it should be noted that the skin structure of *C. pexa* and of two other Thyridids studied is similar to that of some Tortricidae (see Danilevski and Kuznetzov, 1968). A New Zealand species (*Morova subfasciata* Walker) also produces galls on twigs similar to the African species, *C. pexa* (Arnold, 1966).

THE SUBFAMILIES OF THYRIDIDAE

Guenée (1877) first proposed subfamily divisions for the Thyrididae but, although his subfamilies were accepted by Pagenstecher (1892), they were ignored by most subsequent authors (Hampson, 1897; Dalle Torre, 1914; Gaede, 1917 and 1929). The possible use of the subfamily classification proposed by Guenée was mentioned by Whalley (1964a) and a subfamily classification was proposed by Whalley (1967) but without definitions. Originally Guenée proposed three subfamilies ("Pachythyridae, Striglinidae, Siculidae") and these form the basis of the present classification, together with a fourth subfamily which was not known to Guenée (Argyrotypinae). This latter name was first proposed by Hampson for a new family (Argyrotypidae) based on the genus *Argyrotypus* Butler. Subsequently Hampson (1918) regarded *Argyrotypus* as a junior synonym of *Chrysotypus* Butler and altered the family name to Chrysotypidae, a name which was retained by Berger (1957) for a family he regarded as distinct from the Thyrididae. The family, based on the genus *Chrysotypus*, was reclassified as a subfamily of the Thyrididae and the name Argyrotypinae retained for it (Whalley, 1967). This name is retained here, even though the genus on which it is based (*Argyrotypus*) is a junior synonym of *Chrysotypus*, because of the earlier use in a supra-generic sense of a name based on *Argyrotypus*.

The subfamilies in this work are based on a detailed study of the African and

Madagascan faunae and an examination of the type-species of all the world genera. Some modifications may be necessary when other faunal regions are studied.

Argyrotypinae

The species in this subfamily have previously been placed in different subfamilies (p. 34). This subfamily contains medium to large moths (wing, 13–36 mm) usually with a strongly reticulate wing pattern.

Subfamily description. Proboscis usually reduced or absent. Labial palps 3-segmented. Eyes without interfacetal hairs. Ocelli usually absent. Antennae pectinate, lamellate or dentate, never minutely ciliate. Fore tibia with epiphysis. Hind tibia with one or two pairs of spurs, often with tips strongly sclerotized and pointed. Tarsi without spines. Hind wing with $Sc+R_1$ and Rs free. Frenulum present. Male genitalia with simple uncus. Gnathus absent. Valves broad with prominent median process. Aedeagus with lateral process. Female with anal papillae strongly folded. Ostium usually surrounded by sclerotized plate. Bursa simple, duct usually short, signum absent.

This subfamily is known only from Africa and Madagascar and contains two genera, *Chrysotypus* and *Neochrysotypus*.

Pachythyrinae

This subfamily includes the following genera: *Dysodia* Clemens; *Thyris* Laspeyres; *Glanycus* Walker; *Hyperthyris* Leech; and possibly *Gippius* Walker. It contains small to medium-sized moths (wing 8–20 mm), mostly rather fat-bodied species, often with prominent translucent areas in their wings.

Subfamily description. Proboscis usually present. Labial palps 3-segmented. Eyes without interfacetal hairs. Ocelli present or absent. Antennae pectinate, dentate, lamellate or minutely ciliate. Fore tibia with ephiphysis. Hind tibia with two pairs of spurs. Tarsi usually with rows of spines. Hind wing with $Sc+R_1$ and Rs free. Frenulum present. Male genitalia with simple uncus. Gnathus present or absent. A dorsal process (previously termed "dorsal hump", Whalley, 1968) on the tegumen appears as a long or short blind-ending diverticulum, immediately posterior to the uncus. Valves simple, no median process. Females with simple, unfolded anal papillae, without much sclerotization round ostium. Bursa usually with secondary sac. Signum present or absent.

Although this subfamily is pantropical in range there are relatively few species (but still more than the preceding subfamily), mostly in the genus *Dysodia*. The size of the dorsal process on the tegumen of the male genitalia varies but this structure has not been found in any other subfamily and its significance is not known.

Striglinae

This subfamily contains the following genera: *Banisia* Walker; *Neobanisia* Whalley; *Striglina* Guenée; *Canaea* Walker and *Mathoris* Guenée. The wing measurement of species in these genera range from 6–18 mm.

Subfamily description. Proboscis present. Labial palps 3-segmented. Eyes with or without interfacetal hairs. Ocelli present or absent. Antennae pectinate, minutely ciliate or ciliate. Fore tibia with epiphysis. Hind tibia usually with two pairs of spurs. Tarsi with rows of spines or with apical pair of spines on each tarsal segment, never without spines. Hind

wing with $Sc+R_1$ and Rs often fused for part of their length. Frenulum present. Male genitalia usually highly modified. Uncus often bifid, socii well developed. Valves often reduced or highly modified, rarely simple. Female with simple, unfolded anal papillae, often with a well developed, sclerotized, spiny plate around ostium. Signum present or absent.

This subfamily is pantropical and includes genera with, for the Thyrididae, an unusually wide distribution in the Old and New World (e. g. *Banisia*, *Mathoris*). The complicated male genitalia are characteristic of species of this subfamily. The presence of interfacetal hairs on the eyes has not been detected in any other subfamily.

Siculinae

This is the largest subfamily in the Thyrididae and is characterized by species with fairly simple genitalia. The species in this subfamily range in size from 6–27 mm wing. There are several anomalous genera at present in this subfamily. *Cecidothyris* has species with two-segmented labial palps (instead of the more usual three), *Sinecalca* is characterized by species where the frenulum is absent in both sexes. The subfamily is divided into two tribes based on the presence or absence of spines on the tarsal segments. The Rhodoneurini have a pair of spines at the distal end of each tarsal segment, whereas the Opulini have the tarsal segments without spines. In a few species in the last tribe there are spines on the last tarsal segment but not on the others. It is difficult to give an estimate of the number of genera of Thyridids which belong to this subfamily but probably it includes nearly 75% of the world genera.

Subfamily description. Proboscis present. Labial palps 3-segmented, rarely 2-segmented. Eyes without interfacetal hairs. Ocelli absent. Antennae minutely ciliate, pectinate or lamellate. Fore tibia with epiphysis or, rarely, without epiphysis. Hind tibia with one or two pairs of spurs. Tarsi without spines or with apical pair. Hind wing with $Sc+R_1$ and Rs free. Frenulum present or, rarely, absent. Male genitalia generally relatively simple, occasionally with some modifications of valve, uncus or gnathus. Female with simple, unfolded anal papillae. Ostium usually without sclerotized plate. Bursa with or without signum.

The Siculinae contains all the species which cannot be placed in the other subfamilies and, as a result, includes some slightly anomalous genera. When other faunae are studied, further division of this subfamily may be necessary.

Key to Subfamilies

1 Tarsal segments without spines 2
– Tarsal segments with apical pairs or rows of spines 3
2 (1) Large, fat-bodied moths (wing 13–36 mm). Wing pattern usually strongly reticulate. Proboscis usually reduced. Antennae dentate, pectinate, or lamellate, rarely ciliate. Male with broad valve with median process (Pl. 26, figs 135–140). Gnathus absent. Aedeagus usually with lateral process. Females with strongly folded anal papillae . **ARGYROTYPINAE** (p. 34)
– Variable in size. Pattern reticulate or otherwise. Proboscis usually present. Antennae usually minutely ciliate, dentate, less frequently lamellate, or pectinate. Male genitalia not as in Pl. 26, figs 135–140. Female with simple unfolded anal papillae . . . . . . **SICULINAE** (part) (p. 84)
3 (1) Tarsi with apical pairs of spines only 5
– Tarsi with rows of spines on each segment 4

4 (3) Hind wing often with large translucent areas. Fat-bodied moths. Male genitalia with small process on tegumen anteriad to uncus. Valves simple. Female with secondary sac on bursa . . **PACHYTHYRINAE** (p. 47)

– Hind wing usually without large translucent areas, often with $Sc+R_1$ and *Rs* anastomosing shortly. Male genitalia without process on tegumen, often complicated, with bifid, or modified uncus. Valves variously modified. Females usually without secondary sac . . **STRIGLINAE** (part) (p. 51)

5 (3) Hind wing often with $Sc+R_1$ and *Rs* anastomosing shortly. Male genitalia complicated, often with bifid or otherwise modified uncus. Valves highly modified . . . . **STRIGLINAE** (part) (p. 51)

– Hind wing with $Sc+R_1$ and *Rs* free. Male genitalia relatively simple, uncus always single. Valves relatively unmodified . **SICULINAE** (part) (p. 84)

WORLD DISTRIBUTION OF THE GENERA REPRESENTED IN AFRICA AND ITS ISLANDS

Table 1 gives a summary of the world distribution of the genera. Of the 28 genera represented in Africa there are 12 apparently endemic genera. Until other faunal regions have been studied in detail it is not possible to make closer comparisons between the regions. (See table overleaf.)

GEOGRAPHICAL DISTRIBUTION OF THE THYRIDIDAE IN AFRICA AND ITS ISLANDS

The distribution of the species is shown on maps 1–73. On these maps a single spot may represent one specimen or may refer to many specimens collected over several years. The exact localities and details of the records will be found for each species under the heading "Material examined".

The maps illustrate the general aspects of the distribution of the species and provide a visual comparison of the distribution patterns. A small size format for the maps was adopted for several reasons: (1) Lack of ecological data. (2) Lack of precise locality data. (3) Numbers of specimens available, which was very variable for each species, with often very few specimens.

To evaluate the relationship between the species distribution and the vegetation, information on the ecology of the species is needed, but virtually none of this was available for the African Thyridids. The information which was available about a few species concerned only the host plant for the larvae. Frequently this was the only occasion on which the species had been bred and often there is an element of doubt as to the accuracy of the identification of the host plant in the absence of any plant specimens. Although the widely used divisions of the vegetation into "montane, moist woodlands" was considered and the scheme proposed by Carcasson (1964) was tried, the absence of suitable data on the specimens rendered comparisons difficult. For example, the record of a specimen from a "rain-forest" locality in the absence of other data must not be overstressed. Species recorded from this zone may be living in clearings many miles in extent or in the forest canopy and occurring in lower parts of the forest further away from the tropics.

There has been fairly widespread collecting in Africa over the years and the collectors were usually after Lepidoptera in general and not specifically collecting Thyrididae. Therefore we have a reasonably random sample giving a measure of

Genera represented in Africa	Madagascar	Seychelles	Aldabra	Mauritius	Sao Thome	Fernando Po	Indo-Pacific	New World	Palaearctic
1. Chrysotypus	x								
2. Neochrysotypus *									
3. Dysodia							x	x	x
4. Mathoris							x	x	
5. Neobanisia	x			x					
6. Banisia	x	x	x				x	x	x
7. Striglina	x					x	x		
8. Rhodoneura	x	x	x			x	x	x	x
9. Symphleps	x						x		
10. Hapana	x		x	x					
11. Tridesmodes									
12. Epaena									
13. Pyralidoxa									
14. Kuja *									
15. Hypolamprus							x		x
16. Cornuterus *	x								
17. Bupota *									
18. Collinsa							x		
19. Cumbaya *					x				
20. Kalenga *				x					
21. Nakawa *									
22. Nemea *						x			
23. Sijua *		x							
24. Opula									
25. Gnathodes *									
26. Lelymena									
27. Sinecalca *									
28. Cecidothyris									

World distribution of genera represented in Africa.

(* new genera). TABLE 1.

the abundance of the Thyridids in relation to other Lepidoptera. From a study of these collections it is apparent that the Thyridids are not as abundant as some families in collections of Lepidoptera in Africa and that frequently only one or two specimens are collected at any one time.

Since we know little about the biology of the Thyridids, it is possible that their habits are different from those of other Lepidoptera but the few observations available do not suggest that this is likely, for example, they have been collected in mercury vapour light traps. We are thus left with the impression that the number of individuals of each species of Thyridid (with a few exceptions) are small in comparison with those of other lepidopterous families. This is confirmed by field observations (e. g. Carcasson, personal communication).

The remaining discussion on the distribution of the species must be read with all these qualifications (ecology, collectors and lack of general data) in mind.

At present the most northerly point at which species have been collected on the mainland of Africa is on the west coast where several species reach almost 15°N. On the drier east coast, they do not extend beyond 10°N, but in the Nile valley, one species (*H. curvifluus*) has been collected up to 12°N. On the whole it seems that the Thyridids are absent from drier regions.

No Thyridids are known from Africa north of the Sahara although several species occur in other parts of the Palaearctic region. These species are known from south Spain and Corsica but appear not to have crossed the Mediterranean into North Africa. Parts of North Africa are reasonably well collected and it is surprising that no Thyridids have been taken; however, it may again be that North Africa is an unsuitable area for them. This pattern of distribution is similar to that in other groups of animals (Butterflies, Carcasson, 1964; Birds, Moreau, 1966).

From the distribution maps (1–73) several patterns of distribution are apparent. The commonest type of distribution pattern (e.g. Map 62) is one which follows the rain-forest zone of the west, either in the woodlands (and grasslands) around the actual rain-forest or within the rain-forest itself. Other patterns of distribution shown by maps 29 and 48 are where the species is restricted to the east coast or the Rift Valley. As more collecting is done through Africa, these patterns will tend to become clearer and with collection of some ecological data a comparison with the vegetation will be possible.

In one species, *Cecidothyris pexa* Hampson (p. 177), not only are more specimens available than is the case with most species but also host records for the larvae are available. The distribution of this species is shown on map 73 where it is superimposed on to the vegetation zones. *C. pexa* is separated into two subspecies, *C. pexa pexa* Hampson and *C. pexa guttulata* Aurivillius (p. 179). At the extremes of their range these two subspecies are very distinct externally, but where they overlap in southern Central Africa, these differences break down and intermediates occur.

The larvae of *C. pexa* produce galls (Pl. 23, fig. 126) on species of *Terminalia* (Combretaceae). *C. pexa pexa* produces galls on the stems of *Terminalia sericea* Burch, a shrub or small tree 3–12 metres high. *T. sericea* has a scattered distribution over Southern and Eastern Africa (Griffith, 1959) and the distribution of *C. pexa pexa* broadly follows it.

The other subspecies, *C. pexa guttulata* has been bred from *Terminalia avicennoides* Guill. and Perr. (Ufaruna, 1968). No other record of bred material from intervening areas is known, but as can be seen from map 73, *C. pexa guttulata* follows one vegetation-type right across Africa from the West Coast, completely round the main rain-forest zone. Without information on the host plants in the region where these two subspecies meet, it is not known if they are host specific. Certainly the external colour, which is a clear distinction at extremes of their range, becomes unusable where they meet for separating the subspecies.

In the absence of ecological data for the majority of species in relation to vegetation the comparison has only been attempted for this one species but certain facts were obtained when the continent was divided into the zones below. These zones were based on existing information, but also on data provided from this study. For example, the inclusion of Angola in the Congo Basin zone is shown by the figures for the number of species which it has in common with the areas on either side of it. There are 25 species known from Angola of which only 6 occur in S. Africa. On the other hand, of the 25 Angolan species, 17 are found in the Congo, which suggest a greater affinity to this area.

The numbers in brackets are the number of species found in that territory.

North African Zone

No species were recorded from any of the following: Morocco, Algeria, Tunisia, Libya, Egypt.

West African Zone

Senegal (5); Mali (1); Gambia (3); Guinea (11); Sierra Leone (27); Liberia (12); Ivory Coast (28); Ghana (36); Togo (4); Nigeria (36); Fernando Po (3); São Thomé (1); Portuguese Guinea (0); Dahomey (0); Mauretania (0); Niger (0); Upper Volta (0); Annobon (0); Principe (0).

Congo Basin Zone

Cameroon (46); Central African Republic (8); Gabon (31); Rio Muni (7); Republic of the Congo (6); Democratic Republic of the Congo (63); Angola (25).

East African Zone

Uganda (35); Kenya (30); Tanzania (42); Ruanda (3); Burundi (0); (no specimens are known from Zanzibar or Pemba).

North East African Zone

Tchad (0); Sudan (8); Ethiopia (2); Somali Republic (1); Socotra (0).

Southern African Zone (including the Mascarene Islands and Aldabra).

Rhodesia (33); Zambia (24); Malawi (18); Mozambique (16); Botswana (5); Lesotho (1); South West Africa (13); Swaziland (0); South Africa (25); Aldabra (2); Mauritius (3); Reunion (0); Rodriguez (0).

Madagascan Zone
Madagascar (30); Comoro Is (1).

Seychelles Zone (excluding Aldabra).
Mahé (2); La Digue (1); Marie Anne (1); Silhouette (1); Praslin (0); Amirantes (0); an unspecified island in the group (1).

Because the collecting, while widespread, has not been as intensive in some areas as in others, the term "apparent endemic" is used in preference to the rather definite term "endemic". In the following discussion, "apparent endemic species" refers to species or subspecies.

West African Zone
This zone has 7 apparent endemic species out of a total of 61 species in the area. The faunae of the two countries (Ghana and Nigeria) on each side of the rain-forest gap (Dahomey gap) show a similar composition. Both countries have 36 recorded species of which 22 species are common to both countries. The relation of these countries to the Congo Basin zone is similar, Ghana sharing 24 species while Nigeria has 28 species in common with the Congo Basin. Further west in Sierra Leone, of the 26 species occurring there, 19 are species occurring in the Congo Basin zone. The number of species common to both sides of the Dahomey rain-forest gap suggests that the gap has had no effect on the species composition on either side of it. Either when the gap was formed from the continuous block of western rain-forest, the species were fairly evenly distributed or the spread of the species across the gap was not impeded. It is impossible to obtain direct evidence of the direction of spread of the fauna but from the present study it is suggested that this spread was from the Congo Basin into the West African zone. Considering the West African zone as consisting of the countries given on p. 20, comparisons can be made of the species in common between this zone and the others. Out of a total of 61 species, 52 of these also occur in the Congo Basin. Similarly the zone has 31 species in common with the East African zone and 26 species in common with the Southern African zone. With the poorly collected North East African zone, 9 species are common to this and the West African zone.

Congo Basin Zone
This zone is richest in the total number of species (88) but in the countries within the zones the differences in the sizes of collections available is apparent. The Central African Republic has only 8 species while the Cameroon has 46 species. The number of apparent endemics is larger than the West African zone but the total fauna is bigger. However, the ratio of endemic to non-endemics is higher in the Congo Basin than in West Africa (approximately 1 : 9 in the West; 1 : 6 in the Congo, endemics: non-endemics). The Congo Basin zone has 45 species in common with the East African zone. This large number is mainly influenced by species which extend only to the west of Uganda from the Congo and this part of Uganda, as in other groups (e. g. Moreau, 1966) should be regarded as part of the Congo Basin. The Congo Basin has 31 species in common with the Southern African zone and this

lower figure (compared with the East African one) is rather what would be expected from the differences in vegetation types. The reasons for the inclusion of Angola in this zone have already been discussed (p. 20).

East African Zone

This zone has 70 species of which 12 are apparent endemics. The ratio of endemics to non-endemics (1 : 6) is the same as in the Congo Basin zone. The influence of West Uganda on the number of species in common with the Congo has already been mentioned. There are 36 species in the East African zone which are also found in the Southern African zone. Of the countries in the Eastern zone, Tanzania has the largest number of apparent endemics (6) and of these, 3 occur only at Amani. One of these is a subspecies of a Congo species, the other two are species with close connections to others in the Congo. This relationship between the fauna at Amani and the Congo region has already been noted by Carcasson (1964) and Moreau (1966).

North East African Zone

Only ten species have been collected in this vast area and of these seven are widely distributed over the rest of Africa. The single apparent endemic is known only from the holotype specimen.

Southern African Zone

This zone has 60 species of which 15 are apparent endemics. This is a higher ratio of endemics to non-endemics (1 : 4) than in any other zone. Of these apparent endemics, three species occur only in South Africa itself and these are all in the genus *Dysodia*. Two of the apparent endemics in the zone occur in Botswana and South West Africa only; the remainder are from the other countries in the zone. Only three species are known from Mauritius, which is included in this zone because two of the species are Southern African in distribution. The third species is an apparent endemic which has some affinities with species in the Indo-Australian region. Aldabra has two species, one endemic subspecies differing only slightly from the mainland subspecies and one widespread Southern African species, which also occurs on Mauritius.

Madagascan Zone

This zone has 30 species of which 27 are endemic. In this case the term "apparent endemic" is not used since there is more certainty that the species are endemics. The Madagascan fauna has been dealt with in detail elsewhere (Whalley, 1967). One of the three non-endemics is a widespread, tropicopolitan species, another is a common Madagascan species which has been collected once on Mahé in the Seychelles. The third species, *R. zophocrana* occurs on the Comoro Islands and forms part of an as yet undescribed complex from South Africa and the Seychelles (p. 98).

Seychelles Zone

Five species are known from the Seychelles of which three are apparent endemics.

One is known only from the damaged holotype specimen and may be allied to a widespread African species. Two species are striking endemic developments of the very widespread species, *Banisia myrsusalis*. These are obviously very closely allied to *myrsusalis* but show differentiation quite unlike any developments of *myrsusalis* anywhere else over its wide distribution. One species occurs on Madagascar and the other, undescribed, species is part of a complex from the South African and Mascarene areas (p. 98).

SPECIES IN THE ETHIOPIAN REGION IN RELATION TO OTHER FAUNAL REGIONS

While the comparison of species in Africa with those of other faunal regions is limited, as with the genera, by our lack of knowledge of these regions, certain species or species groups are of interest in showing apparent common origin between Indian and African faunal elements. One pantropical species (*B. myrsusalis*), which has probably been widely introduced by man, is discussed on p. 58.

Palaearctic Region

There are few species of Thyrididae in this region; none show any close affinities with the African species.

Neotropical and Nearctic Regions

One species, *M. magica* (p. 51) has some morphological similarities to a South American species, this is discussed on p. 52.

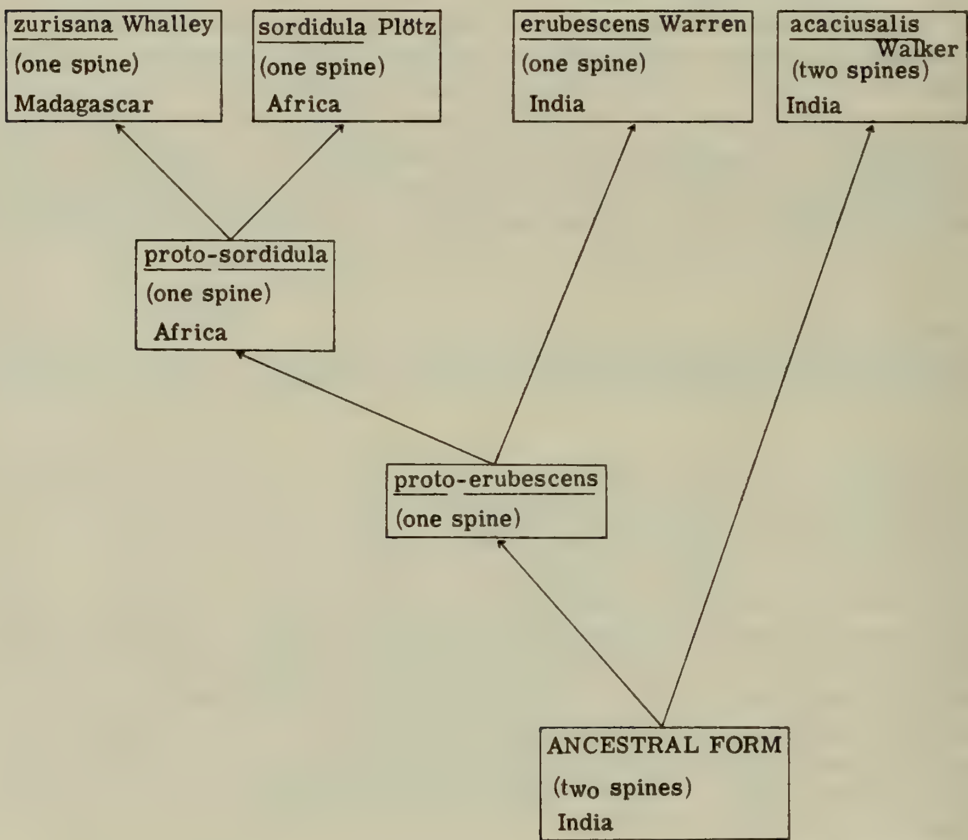
Indo-Pacific and Australasian Regions

At the species level, *S. suffusa* (p. 99) is similar to a species from the Oriental region. *D. intermedia* from Africa and *D. taprobana* from Ceylon are very similar and with many common features suggesting a close common ancestry. A similar case occurs with *H. verticalis* (Africa) and *H. obscuralis* (India). The males of these two species are indistinguishable in external appearance and the genitalia are very similar. Small differences occur in the female genitalia but the general appearance is similar. *H. verticalis* is widespread in Africa and *H. obscuralis* seems to be equally widespread in India.

The possible relationship of African and Indian species of one species-group are shown in Table 2. In this group the differences in morphology between the Madagascan and Indian species are more than between the African and Madagascan one. The African and Madagascan species have a single spine on each tarsal segment and, while one of the Indian species is the same, the other has a pair of spines on each segment. The presence of a pair of spines on the tarsi is here regarded as "ancestral" to the single median tarsal spine and, unless the reduction from the two spine to the one spine condition has taken place on both continents independently (always a possibility), then it seems likely that the Madagascan species was derived from the African one and this in turn was derived from the two-spined Indian species, either directly or indirectly through the one-spined Indian species. Other morphological

characters of the species in this group are similar and the whole species complex seems to be closely related. Table 2, based on the phenetic relationship of these species, is also intended to be an attempt at a phylogenetic relationship of the species in the group.

Table 2. Possible relationship of species of Rhodoneura in India and Africa.
(details in text)



CHECK-LIST OF THYRIDIDAE OF AFRICA AND ITS ISLANDS[2]

(Valid names in **bold** type)

Subfamily **ARGYROTYPINAE**
Genus ***CHRYSOTYPUS*** Butler
ARGYROTYPUS Butler
PROTEROZEUXIS Warren
dawsoni Distant
ansorgei Warren **syn. n.**
pectinifera Hampson **syn. n.**
arcuatalis Gaede **syn. n.**
quadratus sp. n.
tessellatus (Warren) ***comb.*** **n.**
circumfuscus sp. n.
dives Butler
cupreus Kenrick
caryophyllae Frappa
mabillanum Viette
reticulatus sp. n.
subflavus sp. n.

[2]For full synonymy of Madagascan species, see Whalley, 1967.

luteofuscus sp. n.
splendidus (Warren)
vittiferalis (Gaede)
medjensis Holland
perineti (Viette)
animulus Viette
lakato Viette
maculatus Viette
phoebus Viette
locuples (Mabille)
locuples Butler

Genus ***NEOCHRYSOTYPUS*** gen. n.
cerussus sp. n.
mysticus sp. n.

Subfamily **PACHYTHYRINAE**
Genus ***DYSODIA*** Clemens
VARNIA Walker
PLATYTHYRIS Grote
PACHYTHYRIS Felder and Rogenhofer
zelleri (Dewitz)
angulata Warren
hamata Whalley
binoculata Warren
antennata Whalley
fenestrella Warren
constellata Warren
collinsi Whalley
vitrina vitrina (Boisduval)
hyalotypa Bethune-Baker
vitrina flammata Warren
subsignata Warren
intermedia (Walker)
parvita sp. n.
fumida Whalley
lutescens Whalley
crassa (Walker)
magnifica Whalley
incognita Whalley
amania Whalley

Subfamily **STRIGLINAE**
Genus ***MATHORIS*** Guenée
magica Gaede

Genus ***NEOBANISIA*** Whalley
fuliginea sp. n.
joccatia sp. n.
clathrula (Guenée)
inoptata sp. n.
zamia sp. n.
antiopa (Viette)

Genus ***BANISIA*** Walker
myrsusalis elaralis (Walker)
tibiale (Fryer)
apicale (Fryer)
aldabrana aldabrana (Fryer)
aldabrana cana ssp. n.

Genus ***STRIGLINA*** Guenée
PLAGIOSELLA Hampson
PLAGIOSELLULA Strand
HETEROSCHISTA Warren **syn. n.**
eguttalis Gaede
rothi Warren
clathratipennis Strand
minutula Saalmüller
clathrata clathrata Hampson
clathrata amani ssp. n.
clathrata declivita ssp. n.
strigifera Strand
ferula sp. n.
trepida sp. n.
augescere sp. n.
vindicta vindicta ssp. n.
vindicta congoensis ssp. n.
vindicta ivoriensis ssp. n.
ramosa sp. n.
guttistigma Hampson
humeralis sp. n.
jacanda sp. n.
tincta sp. n.
nigranalis (Warren)
lenistrialis Hampson
monotonicata Strand **syn. n.**

Subfamily **SICULINAE**
Tribe **RHODONEURINI**

Genus ***RHODONEURA*** Guenée
OSCA Walker

Subgenus ***RHODONEURA*** Guenée
sordidula (Plötz)
zurisana sp. n.
lacunosa sp. n.
limatula Whalley

seyrigi Viette
strix Viette
superba Viette
terreola (Mabille)
flavicilia Hampson
arcuata Gaede **syn. n.**
abacha sp. n.
roseola sp. n.
disjuncta (Gaede)

Subgenus ***ISOTHAUMA*** Warren
serraticornis Warren
cymoeasticha Bethune-Baker **syn. n.**
phricosticha Bethune-Baker **syn. n.**
phoenicophora Hampson **syn. n.**
nudicornis Gaede **syn. n.**
opalinula (Mabille)
marojejy Viette
werneburgalis (Keferstein)
zophocrana Viette
mellea (Sallmüller)
translucida Viette
elegantula Viette

Genus ***SYMPHLEPS*** Warren
suffusa Warren
signicostata Strand
seta (Viette)

Genus ***HAPANA*** Whalley
verticalis (Warren)
carcealis sp. n.
minima sp. n.
milloti (Viette)

Genus ***TRIDESMODES*** Warren
ramiculata Warren
ansorgei Warren **syn. n.**

Tribe **OPULINI**
Genus ***EPAENA*** Karsch
trijuncta (Warren)
elephantinalis (Karsch) **syn. n.**
inops (Gaede)
candida sp. n.
pellucida sp. n.
danista sp. n.
xystica sp. n.
vocata sp. n.
radiata (Warren)

Genus ***PYRALIDOXA*** Meyrick
stratifica Meyrick
elaphropa (Meyrick)

Genus ***KUJA*** gen. n.
gemmata (Hampson)
catenula (Pagenstecher)
squamigera (Pagenstecher
rostrifera Warren **syn. n.**
obliquifascia (Warren)
fractifascia (Warren)
effrenata sp. n.
hamatipex (Hampson)
kibala sp. n.
carcassoni sp. n.
majuscula (Gaede)

Genus ***HYPOLAMPRUS*** Hampson
curvifluus (Warren)
distrinctus sp. n.
janenschi (Gaede)
quaesitus sp. n.
gangaba sp. n.

Genus ***CORNUTERUS*** gen. n.
nigropunctulus (Pagenstecher)
paratrivius sp. n.
trivius (Whalley)
palairantus (Bethune-Baker)

Genus ***BUPOTA*** gen. n.
tranquilla tranquilla ssp. n.
tranquilla scripta ssp. n.
galbana sp. n.

Genus ***COLLINSA*** Whalley
DOHERTYA Warren [Pre-occupied]
subscripta (Warren)

Genus ***CUMBAYA*** gen. n.
obstinata sp. n.
unigena sp. n.

Genus ***KALENGA*** gen. n.
maculanota sp. n.
culanota sp. n.
ansorgei (Warren)
pusillata Warren
discata Warren

Genus ***NAKAWA*** gen. n.
fuscibasis (Hampson)
fulvipicta (Hampson)

Genus ***NEMEA*** gen. n.
eugrapha (Hampson)
alenica Strand
thermographa Hampson
tamsi sp. n.
nivosa sp. n.
ankole sp. n.
betousalis (Gaede)
bryaxis Fawcett

Genus ***SIJUA*** gen. n.
jejunalis (Gaede)
sigillata (Warren)
plagalis (Gaede)
flavula (Pagenstecher)
furcatula (Pagenstecher)
parvula sp. n.
meriani (Gaede)
neolatizona sp. n.
latizonalis (Hampson)
albisignata Warren
canitia sp. n.

Genus ***OPULA*** Walker
impletalis Walker
micragraphalis Hampson
perigrapha (Hampson)
spilotata (Warren)
miosticta Warren
scardialis (Rebel)
hebes sp. n.
monsterosa sp. n.
chopardi (Viette)
lineata Whalley

Genus ***GNATHODES*** gen. n.
helvella sp. n.
fiscinella sp. n.

Genus ***SINECALCA*** gen. n.
insolita sp. n.
confusa sp. n.

Genus ***LELYMENA*** Karsch
misalis Karsch
palealides Hampson

Genus ***CECIDOTHYRIS*** Aurivillius
pexa pexa (Hampson)
pexa guttulata Aurivillius
chrysotherma (Hampson)
orbiferalis (Gaede)
parobifera sp. n.
tyrannica tyrannica ssp. n
tyrannica affinia ssp. n.
longicorpa sp. n.

SPECIES AND GENERA DESCRIBED IN THE THYRIDIDAE FROM AFRICA AND ITS ISLANDS AND TRANSFERRED TO OTHER FAMILIES

Hypolamprus cyanoxantha Meyrick, 1933 : 443. Holotype ♂, Democratic Republic of the Congo, in MRAC.

This species is here transferred to the Pyralidae, Pyraustinae. The generic placing of this species is difficult in view of the present state of the family but it is close to *Pycnarmon dialithalis* Hampson, described from Ghana. Another species to which *H. cyanoxantha* may be related is *Furcivena rhodoneurialis* Hampson. For the present *H. cyanoxantha* is transferred to the genus *Pycnarmon* Lederer, 1863 and placed near *P. dialithalis* Hampson.

Dysodia calidella Legrand, 1965 : 122. Holotype ♂, Madagascar, in MNHN.

Transferred to the Pyraustinae, Cybalomiinae (Whalley, 1968 : 1), where it was placed in the genus *Thyridophora* Warren, near *T. furia* Swinhoe (not Warren as given in error, Whalley, 1968 : 1).

Dixoa jeanneli Viette, 1954 : 122. Holotype ♂, Madagascar, in MNHN.

Transferred to the Pyralidae, Pyraustinae (Whalley, 1967 : 2), where it was placed, provisionally, in the genus *Syngamia* Guenée.

Syncallia Guérin-Méneville, 1844 : 497. Type-species, *S. stellata* Guérin-Méneville, by monotypy. River Casamance [Senegal].

This genus and species were placed next to *Thyris* by Guérin-Méneville, who indicated that he thought they were related. The name has remained unused but the description has now been recognized by Mr W. H. T. Tams as that of a species at present in *Atteva* Walker, Yponomeutidae. I am therefore transferring the species and genus to the Yponomeutidae. The species at present known as *Atteva cateri* Wals., will become a junior synonym of *S. stellata* Guérin-Méneville.

DEFINITION OF TERMS USED

Basal process	See median basal process.
comb. n.	New combination.
dorsal process of tegumen	A small dorsal projection on the tegumen of the male immediately anterior to the uncus, characteristic of the Pachythyrinae (=dorsal hump, Whalley, 1968).
distal spurs (of tibia)	Spurs on tibia nearest to tarsal segments.
frenulum hook	Small sclerotized loop from underside of costa of fore wing of male into which the frenulum is inserted.
gnathus arms	The lateral processes from the junction of the uncus and tegumen which do not meet in the middle (=brachia). When these arms meet the term gnathus is used for the whole structure.
inner spur (of tibia)	Morphologically nearest to mid-line when insect is at rest.
interfacetal hairs	Hairs present on the eyes between the facets (Pl. 24, fig. 130).
juxta lobes	Frequently the juxta consists of two lateral processes and often a median plate (=median juxta lobe).
median basal process	The process, when present, is at the base of the valves of the male and may be variously modified.
median juxta lobe	See juxta lobe.
median process of valve	Any process on the valve, other than the median basal process (q.v.), in the male. Usually found on or near the middle of the valve itself. This process is not usually associated with the end of the sacculus.
minutely spined	Used in relation to the spines on the vesica of the male or on the bursa of the female, when viewed at ×100 magnifications.
outer spur (of tibia)	Contrast inner spur (q.v.).

proximal spurs	Spurs on tibia furthest from tarsal segments.
radial veins	Generally refers to veins R_2 to R_5 of the fore wing, some of which may be fused near their origin from the cell.
secondary sac	A small sac, which may or may not be present, attached to the bursa of the female.
sp. rev.	Species name, previously in synonymy, now used as the valid name for a distinct species.
uncus simple	Refers to the single elongate uncus found in many species. (e. g. Pl. 36, fig. 197).
valve simple	Margin of valve without processes (occasionally a process will project over the margin, this must be differentiated from a process arising on the actual margin).
wing "x" mm	All wing measurements given are taken from the apex of the fore wing to the centre of the mesothorax. Wing span would be approximately twice this figure.

ABBREVIATIONS

AMNH	American Museum of Natural History, New York.
BMNH	British Museum (Natural History), London.
CMP	Carnegie Museum, Pittsburgh.
CNC	Canadian National Collection, Ottawa.
CT	South African Museum, Cape Town.
DEIB	Deutsches Entomologisches Institut, Eberswalde.
DZUC	Department of Zoology, University of Cambridge, Cambridge, U.K.
HNHM	Hungarian Natural History Museum, Budapest.
MG	Mission Biologique au Gabon (Specimens in Muséum National d'Histoire Naturelle, Paris).
MMB	Moravian Museum, Brno.
MNHN	Muséum National d'Histoire Naturelle, Paris.
MRAC	Musée Royale de l'Afrique Centrale, Tervuren.
NHV	Naturhistorisches Museum, Vienna.
NMK	National Museum, Nairobi (formerly Coryndon Museum).
NMR	National Museum, Bulawayo.
NR	Naturhistoriska Riksmuseet, Stockholm.
TMP	Transvaal Museum, Pretoria.
UMO	University Museum, Oxford, U.K.
USNM	United States National Museum, Washington.
ZMB	Institut für Spezielle Zoologie und Zoologisches Museum, Berlin.

The abbreviation BMNH is used only in connection with the type-specimen. In all other cases, specimens which do not have an abbreviation of a museum after them are in the collection of the British Museum (Natural History).

NAMES OF COUNTRIES AND TOWNS

With the changing of many of the names on the map of Africa, localities for specimens are given as they appear on the specimen labels, with the new name (if needed) in brackets. For the territories in the Congo Basin the following nomenclature is adopted.

Central African Republic	= former French Equatorial Africa (Ubangi-Shari).
Democratic Republic of the Congo	= former Belgian Congo (Congo-Kinshasa or Congo-Leopoldville).
Republic of the Congo	= former French Equatorial Africa (Middle Congo, Congo-Brazzaville).

Malagasy Republic is used where Madagascar is referred to in its present political sense but "Madagascar" is retained in the geographical sense for the main island only. For Madagascar, Comoro Is, Réunion, Rodriguez and Mauritius the term Mascarene is retained.

In the material examined, the collector's name is in italics in the brackets, the month of collection in roman numerals and the countries are listed in the same sequence in each species, roughly in a west to east sequence, then southwards.

Key to Genera: Males

1		Frenulum present	2
–		Frenulum absent	***SINECALCA*** (p. 172)
2	(1)	Transtilla modified into two long arms (Pl. 27, figs 143, 145)	***NEOCHRYSOTYPUS*** (p. 45)
–		Transtilla not so modified	3
3	(2)	Gnathus reduced or absent	4
–		Gnathus present or with prominent gnathus arms (brachia)	10
4	(3)	Median process on valve (Pl. 26, figs 135–142)	5
–		No median process on valve	7
5	(4)	Aedeagus with lateral process, valve broad	***CHRYSOTYPUS*** (p. 35)
–		Aedeagus simple, valve generally narrowing towards apex	6
6	(5)	Juxta with four lobes. Genitalia as in Pl. 37, fig. 208 . .	***KUJA*** (part) (p. 117)
–		Juxta with one or two lobes. Genitalia as in Pl. 40, fig. 221	***CORNUTERUS*** (part) (p. 133)
7	(4)	Tarsal spines absent	***CORNUTERUS*** (part) (p. 133)
–		Tarsal spines present	8
8	(7)	Tarsi with apical pair of spines (Pl. 25, fig. 134). Fore wing with $R_3+R_4+R_5$ or with R_3+R_4	9
–		Tarsi usually with rows of spines. Fore wing with radial veins from cell or with R_3+R_4	***DYSODIA*** (part) (p. 47)
9	(8)	Fore wing with $R_3+R_4+R_5$	***TRIDESMODES*** (p. 104)
–		Fore wing with R_3+R_4	***HAPANA*** (p. 100)
10	(3)	Spines on all tarsal segments, either apical pairs or rows	11
–		Tarsi without spines or with spines on last tarsal segment only	21
11	(10)	Tarsal spines in apical pairs	13
–		Tarsal spines in rows, often numerous	12
12	(11)	Uncus simple (Pl. 27, fig. 146)	***DYSODIA*** (part) (p. 47)
–		Uncus modified	***STRIGLINA*** (part) (p. 64)

13 (11)	Eyes flattened on posterior margin or slightly reniform	***MATHORIS*** (p. 51)
–	Eyes rounded	14
14 (13)	Uncus simple	15
–	Uncus modified, bifid or clavate	18
15 (14)	Valve with prominent hair pencil (Pl. 33, fig. 178)	***STRIGLINA*** (part) (p. 64)
–	Valve simple, without hair pencil. Genitalia not as in Pl. 33, fig. 178	16
16 (15)	Socii well developed (Pl. 28, figs 148–152)	***NEOBANISIA*** (part) (p. 52)
–	Socii small or absent	17
17 (16)	Manica weakly spined. Basal process or valve strongly hooked and upturned (Pl. 35, fig. 193)	***HAPANA*** (part) (p. 100)
–	Manica usually strongly spined. Basal process on valve only slightly hooked	***RHODONEURA*** (p. 84)
18 (14)	Eyes with interfacetal hairs	***STRIGLINA*** (part) (p. 64)
–	Eyes without interfacetal hairs	19
19 (18)	Uncus bifid or trifid	20
–	Uncus single, clavate	***SYMPHLEPS*** (part) (p. 98)
20 (19)	Gnathus with peg-like teeth. Valves reduced	***STRIGLINA*** (part) (p. 64)
–	Gnathus otherwise shaped. Valves usually not reduced	***BANISIA*** (p. 58)
21 (10)	Labial palps 2-segmented	***CECIDOTHYRIS*** (p. 176)
–	Labial palps 3-segmented	22
22 (21)	Fore wing with $R_2+R_3+R_4$	***EPAENA*** (part) (p. 106)
–	Fore wing with radial veins from cell or some veins joined, but never $R_2+R_3+R_4$	23
23 (22)	Uncus modified, clavate, bifid, or otherwise modified	24
–	Uncus simple, sometimes elongate, always single	27
24 (23)	Process on margin of valves	***GNATHODES*** (part) (p. 170)
–	Valve simple or with median process which may project beyond margin of valves, no process on margin	25
25 (24)	White species, underside of fore wing without black and silver scales	***PYRALIDOXA*** (p. 115)
–	Otherwise coloured. Prominent black and silver scales in cell under fore wing (Pl. 12, fig. 60)	26
26 (25)	Prominent spiny cornutus in aedeagus (Pl. 41, fig. 228)	***CUMBAYA*** (part) (p. 141)
–	Cornutus, if present, not as above	***KUJA*** (part) (p. 117)
27 (23)	Valve with lateral process on margin	***GNATHODES*** (part) (p. 170)
–	Valve simple in outline or with median process	28
28 (27)	Small spines at base of valve (Pl. 41, fig. 229). Aedeagus with one or more sclerotized processes	***CUMBAYA*** (part) (p. 141)
–	No small spines at base of valve. Aedeagus not as above	29
29 (28)	Fore wing with radial veins arising separately from cell	36
–	Fore wing with some radial veins stalked	30
30 (29)	Fore wing with R_4+R_5	31
–	Fore wing with other radial veins joined, not R_4+R_5	34
31 (30)	Antennae strongly ciliate, or if only moderately ciliate, species not white	32
–	Antennae minutely ciliate, white coloured species	***EPAENA*** (part) (p. 106)
32 (31)	Valve broad. Manica without spines. Gnathus arms short. Large, pale lemon-yellow species with black veins in fore wing	***LELYMENA*** (p. 174)
–	Not as above, Gnathus, usually a complete loop	33
33 (32)	Gnathus greatly enlarged	***NEMEA*** (part) (p. 149)
–	Gnathus not enlarged	***BUPOTA*** (part) (p. 136)
34 (30)	Gnathus arms not meeting in mid-line. Pointed median process on valve (Pl. 38, fig. 212)	***KUJA*** (part) (p. 117)
–	Not as above	35
35 (34)	Genitalia as in Pl. 38, fig. 214	***HYPOLAMPRUS*** (part) (p. 127)
–	Genitalia not as in Pl. 38, fig. 214	***EPAENA*** (part) (p. 106)

36	(29)	Juxta lobes incurved at apex . . . . . (some specimens of ***NEMEA*** may come out here)	***OPULA*** (part) (p. 163)
–		Juxta lobes not incurved at apex	37
37	(36)	Antennae simple, minutely ciliate	43
–		Antennae ciliate, serrate or monopectinate	38
38	(37)	Antennae monopectinate	***HYPOLAMPRUS*** (part) (p. 127)
–		Antennae serrate or ciliate	39
39	(38)	Antennae strongly serrate. Prominent black and silver scales in cell on underside of fore wing	***KUJA*** (part) (p. 117)
–		Antennae strongly ciliate. No black and silver scales under fore wing . .	40
40	(39)	Juxta with prominent process (Pl. 39, fig. 217) .	***HYPOLAMPRUS*** (part) (p. 127)
–		Juxta not modified as above	41
41	(40)	Genitalia as in Pl. 43, fig. 242. Uncus long, well sclerotized	***NEMEA*** (part) (p. 149)
–		Genitalia not as above	42
42	(41)	Wings sandy yellow, reticulations indistinct . .	***BUPOTA*** (part) (p. 136)
–		Wings brown, with strong reticulate pattern . .	***KALENGA*** (part) (p. 143)
43	(37)	Hind tibia with apical spurs paired, and single long median spur (occasionally a small, second, median spur very reduced) . . .	***COLLINSA*** (p. 139)
–		Hind tibia with two pairs of spurs, median pair on tibia conspicuous . .	44
44	(43)	Juxta with prominent spines on inner margin . .	***KALENGA*** (part) (p. 143)
–		Juxta without spines on inner margin	45
45	(44)	Valve with elongate basal process (Pl. 38, fig. 209) . .	***KUJA*** (part) (p. 117)
–		Basal process not as above	46
46	(45)	Juxta with two elongate lateral lobes. Genitalia as Pl. 42, fig. 234	***NAKAWA*** (p. 147)
–		Juxta not as above	47
47	(46)	Hind wing with two median brown or black spotted fasciae between two white fasciae (Pl. 20, figs 106, 108)	***SIJUA*** (part) (p. 154)
–		Hind wings without such fasciae	48
48	(47)	Prominent black and silver scales under fore wing arranged as small spots (Pl. 13, figs 64, 66). Brown line from below apex of fore wing to costal margin	***KUJA*** (part) (p. 117)
–		Not as above	49
49	(48)	Gnathus without median process (Pls 38, 39, figs 214–219)	***HYPOLAMPRUS*** (part) (p. 127)
–		Gnathus with small or large median process	50
50	(49)	Uncus sclerotized and pointed (Pl. 42, fig. 239) . .	***NEMEA*** (part) (p. 149)
–		Uncus not as above	51
51	(50)	Prominent Y-shaped sclerite on 9th tergum . . .	***SIJUA*** (part) (p. 154)
–		No Y-shaped sclerite on 9th tergum	52
52	(51)	Large species, wing over 18 mm.	***OPULA*** (part) (p. 163)
–		Smaller species, wing under 18 mm	***NEMEA*** (part) (p. 149)

Key to Genera: Females

1		Frenulum absent	***SINECALCA*** (p. 172)
–		Frenulum present	2
2	(1)	Labial palps 3-segmented	3
–		Labial palps 2-segmented	***CECIDOTHYRIS*** (p. 176)
3	(2)	All tarsal segments with spines	4
–		Tarsal segments without spines or with spines on last tarsal segment only .	17
4	(3)	Tarsi with pair of apical spines	6
–		Tarsi with rows of spines	5

5 (4) Secondary sac usually present on bursa. Bursa with or without signum. Fore wing with or without some fusion of radial veins. Terminal margin of fore wing and of hind wing usually sinuous. Frequently with translucent area in hind wing . . . . ***DYSODIA*** (p. 47)
– No secondary sac on bursa. Signum present or absent. Fore wing with or without fusion of some radial veins . . . ***STRIGLINA*** (part) (p. 64)
6 (4) Signum in bursa 7
– No signum in bursa 13
7 (6) Signum formed by one or two patches of spines (Pl. 57, figs 343, 345) ***HAPANA*** (p. 100)
– Signum not as in above 8
8 (7) Eyes without interfacetal hairs 9
– Eyes with interfacetal hairs . . . . . ***STRIGLINA*** (part) (p. 64)
9 (8) Signum thorn-like (Pl. 56, fig. 340) . . . . . ***SYMPHLEPS*** (p. 98)
– Signum not as above 10
10 (9) Signum a large patch of plate-like spines (Pl. 51, fig. 298) . ***BANISIA*** (p. 58)
– Signum not as above 11
11 (10) Fore wing with some radial veins joined . . ***RHODONEURA*** (part) (p. 84)
– Fore wing with radial veins separately from cell 12
12 (11) Wing over 15 mm . . . . ***STRIGLINA*** (part) (p. 64)
– Wing under 15 mm . . . . ***NEOBANISIA*** (part) (p. 52)
13 (6) Radial veins separately from cell . . . . ***RHODONEURA*** (p. 84)
– Some radial veins joined 14
14 (13) Eyes rounded when viewed laterally 15
– Eyes with posterior margin truncate (Text-fig. 3). . . ***MATHORIS*** (p. 51)
15 (14) Brown species. Fore wing with R_2+R_3. Ostium strongly sclerotized ***NEOBANISIA*** (part) (p. 52)
– Brown or white species. Fore wing either with $R_3+R_4+R_5$ or with R_2+R_3 and R_4+R_5 16
16 (15) White species, $R_3+R_4+R_5$ in fore wing . . . ***TRIDESMODES*** (p. 104)
– Brown species. Fore wing with R_2+R_3 and R_4+R_5 . ***STRIGLINA*** (part) (p. 64)
17 (3) Anal papillae strongly folded (Pls 48, 49, figs 272–284). Duct short, no signum ***CHRYSOTYPUS*** (p. 35)
– Anal papillae not strongly folded 18
18 (17) Large species, wing 18–25 mm. Pale lemon-yellow with black veins in fore wing, no reticulate pattern (Pl. 2, L.) . . . . ***LELYMENA*** (p. 174)
– Otherwise coloured 19
19 (18) White species. Fore wing with $R_2+R_3+R_4$ . . ***EPAENA*** (part) (p. 106)
– White or coloured species. Radial veins of fore wing from cell or some joined but never $R_2+R_3+R_4$ 20
20 (19) Some radial veins in fore wing joined 21
– All radial veins free 27
21 (20) Fore wing with $R_3+R_4+R_5$ 22
– Only two radial veins joined 23
22 (21) Duct and bursa lightly spined (Pl. 58, fig. 350) . . ***EPAENA*** (part) (p. 106)
– Duct and bursa heavily spined (Pl. 59, figs 360, 361) . ***PYRALIDOXA*** (p. 115)
23 (21) Fore wing with R_4+R_5 24
– Fore wing with R_3+R_4 25
24 (23) Large white species. Genitalia as in Pl. 64, figs 403, 404 ***NEMEA*** (part) (p. 149)
– Small brown or reddish brown species. Genitalia as in Pl. 63, fig. 391 ***BUPOTA*** (part) (p. 136)
25 (23) Signum in bursa usually two thorn-like spines . ***HYPOLAMPRUS*** (part) (p. 127)
– No signum 26
26 (25) Black and silver scales in cell under fore wing. Genitalia as in Pl. 63, figs 394, 395 . . . . ***CUMBAYA*** (p. 141)

– No black and silver scales under fore wing . . ***EPAENA*** (part) (p. 106)
27 (20) Signum in bursa 28
– No signum, although bursa may be covered with minute spines . . . 31
28 (27) Signum two thorn-like plates . . . . ***HYPOLAMPRUS*** (part) (p. 127)
– Signum otherwise shaped 29
29 (28) Bursa with large patch of spines or single large sclerotized hook-shaped plate (Pl. 62, figs 387–390) . . . . ***CORNUTERUS*** (p. 133)
– Signum otherwise shaped 30
30 (29) Signum a spiny plate (Pls 66, 67, figs 423, 427, 430) . ***OPULA*** (part) (p. 163)
– Signum one small patch or several patches of spines (Pl. 65, figs. 410, 413) ***SIJUA*** (part) (p. 154)
31 (27) Fore wing with pattern as Pl. 13, fig. 63. Underside with prominent black and silver scale patches as Pl. 13, fig. 64 . . . . ***KUJA*** (part) (p. 117)
– Pattern not as in above 32
32 (31) Sclerotized plate over ostium (Pl. 64, fig. 407). Pattern as in Pl. 22, fig. 115 ***GNATHODES*** (p. 170)
– Genitalia not as in Pl. 64, fig. 407. Pattern not as in above 33
33 (32) Hind tibia with longest proximal tibial spur almost reaching tip of shortest distal spur. Pattern as in Pl. 1, L; Pl. 17, figs 88, 89 . . ***KALENGA*** (p. 143)
– Hind tibia with proximal tibial spur very short or with longest proximal spur not reaching tip of shortest distal spur 34
34 (33) Proximal pair of spurs of hind tibia with one long and one very short spur, latter often not visible through scale cover of tibia 35
– Both proximal spurs on hind tibia clearly visible, spurs not noticeably reduced 36
35 (34) Sandy yellow colour. Reticulations indistinct . . ***BUPOTA*** (part) (p. 136)
– Reddish brown species. Reticulations distinct, often with purplish tinge ***COLLINSA*** (p. 139)
36 (34) Prominent black and silver scales in patch under fore wing, as in Pl. 12, figs 58, 60 . . . . ***KUJA*** (part) (p. 117)
– Scale patch absent or black scales scattered along veins 37
37 (36) Hind wing with distinct median fascia 38
– No distinct fascia in hind wing 41
38 (37) Larger species, wing over 14 mm. Brown triangular patch on fore wing at junction of terminal and hind margins (anal angle) . ***NEMEA*** (part) (p. 149)
– Not as above 39
39 (38) Hind wing with median fascia made up of many black or brown spots ***SIJUA*** (part) (p. 154)
– Hind wing with complete median fascia 40
40 (39) Fore wing greyish white, white spot below apex (Pl. 20, fig. 107) ***SIJUA*** (part) (p. 154)
– Fore wing brown, often large brown patch in posterior part of median fascia ***NEMEA*** (part) (p. 149)
41 (37) White or grey-white species. Reticulation indistinct (Pl. 2, A; Pl. 17, fig. 90). Genitalia as in Pl. 42, fig. 234. . . . . . . ***NAKAWA*** (p. 147)
– Yellowish brown species. Distinctly reticulate pattern (Pl. 19, fig. 100; Pl. 20, fig. 104). Genitalia as in Pl. 65, figs 411, 414 . . . ***SIJUA*** (part) (p. 154)

ARGYROTYPINAE

The species in this subfamily are known only from Africa and Madagascar, where they are separated into two genera (*Chrysotypus*, *Neochrysotypus*). The characters of this subfamily are given on page 15.

CHRYSOTYPUS Butler

Chrysotypus Butler, 1879 : 240. Type-species, *Chrysotypus dives* Butler, by original designation.
Argyrotypus Butler, 1879 : 241. Type-species, *Argyrotypus locuples* Butler, by original designation. (Synonymized by Whalley, 1964a : 118.)
Proterozeuxis Warren, 1899a : 7. Type-species, *Proterozeuxis splendida* Warren, by original designation. (Synonymized by Whalley, 1964a: 118.)
Chrysotypus Butler; Whalley, 1967 : 4.

This genus has a very complicated taxonomic history (Whalley, 1967 : 4). Morphologically this genus, together with the newly described *Neochrysotypus*, is very distinct from other genera in the Thyrididae and the older genus has previously been referred to a family of its own (Chrysotypidae, Berger, 1957) or placed in a different family (Cossidae, Bryk, 1937). All the characters of the genera (with the possible exception of the characteristically shaped aedeagus) appear in other genera in varying degrees of development but together in the Argyrotypinae produce a very distinct group.

In view of these differences I am retaining the Argyrotypinae as a separate subfamily of the Thyrididae as previously used (Whalley, 1967), with *Chrysotypus* and *Neochrysotypus*.

Chrysotypus can be readily separated from *Neochrysotypus* by the shape of the antennae and the presence or absence of the modifications of the transtilla. Externally the species of *Chrysotypus*, most of which have a typical reticulate pattern, are less distinct from the other Thyrididae than is indicated by the structure of the genitalia. The genitalia in the males of *Chrysotypus* tend to be rather uniform between different species with only small specific differences.

Chrysotypus is only known from Africa and Madagascar. Eighteen species are known, of which nine are endemic to Madagascar, while the others are African endemics with various distributions. The most widespread species is *C. dawsoni*, while some of the other species seem to be very localized, but lack of collections makes this difficult to assess. *C. luteofuscus*, *C. quadratus* and *C. circumfuscus* have a distinct rain-forest distribution, while *C. subflavus* is restricted to the drier parts of South West Africa.

The main difference between the African and Madagascan species of this genus is in the greater development of this bifid form of the aedeagus in Madagascan species, whereas in African species this is often reduced to a small lateral projection.

Generic description. Proboscis usually absent or reduced. Eyes without interfacetal hairs. Antennae pectinate, lamellate or dentate, never minutely ciliate ("simple") in the male, occasionally so in the female. Labial palps 3-segmented. Fore tibia with epiphysis. Hind tibia with one or two pairs of spurs. Tarsi without spines. Male genitalia with simple uncus. Gnathus very reduced or absent. Valves broad with prominent median process. Juxta usually with prominent lateral arms. Aedeagus either strongly bifid or with prominent lateral process, never completely smooth. Female with strongly folded (crenellate) anal papillae with sclerotized collar round opening of ductus bursae. Duct short, signum absent.

Biology. Nothing is known of the biology of the African species. In Madagascar, *C. caryophyllae* Frappa is a pest of *Eugenia caryophyllae* Thunb. (Myrtaceae) and some data on times of occurence of the Madagascan species are given by Whalley (1967 : 10), with details of life history by Frappa (1954b : 128).

KEY TO THE AFRICAN SPECIES OF *CHRYSOTYPUS*

1 Pale yellow species with faint reticulation . . . . **subflavus** (p. 41)
– Reticulations or pattern more distinct 2
2 (1) Single pair of tibial spurs . . . . **circumfuscus** (p. 39)
(Some specimens of *vittiferalis* with reduced spurs may come out here.)
– Two pairs of tibial spurs, proximal pair sometimes very reduced . . . 3
3 (2) Ground colour whitish or yellowish, strong reticulate pattern and black discal spot in fore and hind wing (discal spot often a small black ring) . . . 4
– Not as above 5
4 (3) Ground colour whitish. Black discal spot in fore and hind wing very distinct. Y-shaped subapical line on fore wing. Genitalia as in Pl. 26, fig. 137 (♂); Pl. 49, figs 279, 280 (♀) . . . . **tessellatus** (p. 38)
– Ground colour yellowish. Black discal spot on fore and hind wing less clear than previous species. Subapical line straight. Genitalia as in Pl. 26, fig. 139 (♂); Pl. 49, figs 283, 284 (♀) . . . . **reticulatus** (p. 41)
5 (3) Wing pattern with prominent transverse fascia, ground colour yellowish. Reticulations not distinct (Pl. 3, fig. 6). Juxta of male with lateral teeth **luteofuscus** (p. 42)
– Not as above 6
6 (5) Large species (wing 20 mm or over), strongly reticulate pattern and prominently pectinate antennae (Pl. 4, fig. 9) . . . . . . **vittiferalis** (p. 44)
– Not as above 7
7 (6) Ground colour dark reddish brown, prominent square-shaped discal spot on fore wing and often on hind wing. Juxta in male apically toothed **quadratus** (p. 38)
– Not as above 8
8 (7) Wing generally under 19 mm. Ground colour yellowish brown, reticulations as in Pl. 4, fig. 7. Juxta of male with short lateral lobes . . **splendidus** (p. 43)
– Wings generally over 19 mm. Ground colour dark brown, reticulations as in Pl. 3, fig. 1. Juxta of male with elongate lateral lobes . **dawsoni** (p. 36)

Chrysotypus dawsoni Distant

(Pl. 3, figs 1, 2; Pl. 26, fig. 135; Pl. 48, figs 272, 273; Text-fig. 15)

Chrysotypus dawsoni Distant, 1897 : 210.
Proterozeuxis ansorgei Warren, 1899b : 289, **syn. n.**
Plagiosella pectinifera Hampson, 1906 : 122, **syn. n.**
Proterozeuxis brunnea Warren, 1908 : 346, **syn. n.**
Plagiosella pectinifera Hampson; Dalle Torre, 1914 : 39.
Proterozeuxis arcuatalis Gaede, 1917 : 381, **syn. n.**

♂. Wing, 19–29·5 mm. Vertex brown, flattened between antennae. Tuft of brown scales on frons projecting between eyes. Clypeus slightly swollen. Proboscis reduced. Antennae strongly bipectinate. Labial palps with third segment 1/3 length of second, projecting slightly beyond head. Thorax light brown. Hind tibia with two pairs of short spurs, outer spur approximately equal in length to inner spur. Abdomen brown. Fore wing, pattern as in Pl. 3, fig. 1, brown with darker markings. Veins R_4 and R_5 shortly stalked. Underside similar, paler coloured. Hind wing, colour and pattern as fore wing. Veins $Sc+R_1$ not joining Rs. Cell closed.

GENITALIA ♂ (Pl. 26, fig. 135). Lateral arms of juxta slightly hairy, main part of juxta apically expanded.

♀. Wing, 25·5–34·5 mm (Pl. 3, fig. 2). Colour and pattern as in male. Labial palps with third segment 1/3 length of second.

GENITALIA ♀ (Pl. 48, figs 272, 273; Text-fig. 15). No signum. Neck of duct broadly sclerotized.

DISCUSSION. This species is very variable in size and pattern but little variation has been found in the structures of the genitalia. There is a tendency for the South African specimens to be smaller than the specimens from West Africa but there is overlap in size. The largest specimen is a female from Mt Elgon, Uganda. Although over 50 specimens were examined, no distinct trend to subspeciation was detected in this widespread species.

DISTRIBUTION. Map 1. Senegal; Guinea; Sierra Leone; Ghana; Nigeria; Sudan; Cameroon; Central African Republic; Democratic Republic of the Congo; Uganda; Kenya; Tanzania; Zambia; Rhodesia; South West Africa; South Africa.

MATERIAL EXAMINED.

Holotype ♂ (*dawsoni*), SOUTH AFRICA: Transvaal, Barberton (*Dawson*), BM slide no. 9544, in BMNH; Holotype ♀ (*ansorgei*), UGANDA: Masindi (*Ansorge*) 17.i.1898, BM slide no. 9549, in BMNH; Holotype ♂ (*pectinifera*), SIERRA LEONE: 3.v.1895, BM slide no. 9541, in BMNH; LECTOTYPE ♂ (*brunnea*), here designated, SOUTH AFRICA: Transvaal, Shilouvane (*Junod*), xi–xii.1901, BM slide no. 9542, in BMNH; Holotype ♂ (*arcuatalis*), TANZANIA: (*Brandon*), SG., BM slide no. 9629, in ZMB.

SENEGAL: 1 ♂, 1 ♀, Sedhiou (*Castell*), 1917; GUINEA: 1 ♀, Beyla (*Mrázek*), in MMB; SIERRA LEONE: 1 ♂ (*Frère*); GHANA: 1 ♂, Northern Territories, Kete-Krachi (*Cardinall*); NIGERIA: 1 ♂, Ikom (*E. H.*), vii.1930; 1 ♀ Ropp, iv.1920; SUDAN: 1 ♂, Bahr-el-Ghazal, Meridi; CAMEROON: 1 ♀, Yaunde, i–v.1923, in CMP; CENTRAL AFRICAN REPUBLIC: 2 ♂, 1 ♀, Fort Crampel (*Le Moult*); 1 ♂, Yalinga, Oubangui (*Le Testu*); DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♀, Kivu, Salaia (*Andry*), 1957, in MRAC; 1 ♀, Katanga Distr., Sandoa, vii.1934; 1 ♂, Haut-Uelé, Moto (*Burgeon*), 1923, in MRAC; 1 ♂, Luvua River, east bank, 85 miles N. of Lake Mweru (*Barns*), iv.1922, 3000 ft, end of wet season; 5 ♂, Elisabethville (*Seydel*), xi.1951, ii.1952, xii.1954, i.1955, in CMP; UGANDA: 1 ♀, Mt Elgon (*Jackson*), 1926; KENYA: 1 ♂, Kitale (*Jeffery*), iv.1926; 1 ♀, Kitale (*Howard*), iv.1954; 2 ♂, 3 ♀, Suna, S. Kavirondo (*Feather*), xi.1931, iii–iv.1932; TANZANIA: 1 ♂, Tabora, Ounyanyembe (*Hauttecaeur*), 1885; 1 ♀, Tabora Tewlny (*Johnstone*), xii.1933, 3000 ft; 1 ♂, Kilosa (*Miller*), xii.1925, at light; 1 ♀, Nzega (*Bishop*), xii.1957; ZAMBIA: 1 ♂, Lusaka (*Kettlewell*), xi.1950; RHODESIA: 1 ♂, Umvuma (*Janse*), xii.1917, in TMP; 1 ♂, Sawmills (*Stevenson*), xi.1924, in TMP; 1 ♂, Bulawayo (*Stevenson*), xii.1924, in TMP; 1 ♂, Wankie (*Tylor*), iii.1925, in TMP; 1 ♀, Khami, xii.1950, in NMR; 1 ♂, Khami, Matabeleland, xi.1960, in NMR; SOUTH WEST AFRICA: 1 ♂, Abachaus (*Meyer*), xii.1941, in TMP; 1 ♂, Abachaus (*Hobohm*), xii.1945, in TMP; SOUTH AFRICA: 1 ♂, Transvaal, Shilouvane (*Junod*), xi–xii.1901 (paralectotype of *brunnea*); 1 ♀, Transvaal, Shilouvane (*Junod*), xi.1902 (paralectotype of *brunnea*); 2 ♂, Transvaal, Zoupassberg, Shilouvane (*Junod*), 1906; 1 ♀, Transvaal, Lydenburg Distr. (*Distant*); 1 ♂, Pretoria (*Prasesky*), i.1954; 1 ♀, Zoutpan, Pta (*van Son*), xii.1925, in TMP; 1 ♂, Noordkaap (*Jeffery*), in TMP; 1 ♀, Punda Milia, KNP Survey (*Vari & Rorke*), xi.1961, in TMP; no locality, 1 ♂, W. Africa (*Marquand*).

Chrysotypus quadratus sp. n.

(Pl. 2, J; Pl. 26, fig. 136; Pl. 48, figs 274, 275)

♂. Wing, 23·5–27 mm. Vertex dark brown, scales on frons not projecting between eyes, clypeus slightly swollen. Antennae strongly bipectinate. Proboscis vestigial. Labial palps with third segment 1/3 length of second, upturned, not reaching vertex. Patagium very dark brown, rest of thorax lighter brown. Underside of thorax light brown with long scales. Hind tibia with two pairs of spurs, inner spur of distal pair slightly shorter than outer. Proximal pair of spurs only slightly longer than scale cover of tibia. Fore wing, pattern as in Pl. 2, J, brown with dark brown costal margin and dark brown reticulations. Discal brown patch. Terminal margin strongly convex. Veins R_4 and R_5 shortly stalked. Hind wing, colour and pattern as fore wing, margin of wing darker brown. Veins $Sc+R_1$ and Rs free, cell closed.

Genitalia ♂ (Pl. 26, fig. 136). Gnathus absent, gnathus arms weakly sclerotized. Lateral arms of juxta strap-like, median arms with toothed edge.

♀. Wing, 35·5 mm. Pattern as in male. Colour generally paler than male. Labial palps with third segment ½ length of second. Antennae strongly bipectinate, pectinations nearly as long as male. Proboscis present, short and slender.

Genitalia ♀ (Pl. 48, figs 274, 275). Sclerotized neck of duct narrower than *dawsoni*. No signum.

Discussion. The intensity of the brown colour varies. From *C. dawsoni* the male of *quadratus* can usually be separated by the shorter antennal pectinations (0·48 mm, *quadratus*; 0·60 mm, *dawsoni*) but there is some overlap. The shape of the juxta and the median process of the valve enable the males of the two species to be separated reliably. The females can be separated on the length of the antennal pectinations (0·3 mm, *quadratus*; 0·56 mm, *dawsoni*) and by the opening of the duct which in *quadratus* is narrower than in *dawsoni*. The specimens from Angola are constant in colour and pattern but the single specimen from Kitale, Kenya probably represents a new subspecies. The wings of the Kenyan specimen are narrower and it is darker than specimens from the type-locality.

Distribution. Map 2. Democratic Republic of the Congo; Kenya; Tanzania; Angola.

Material examined.

Holotype ♂, Angola: Upper Lungwe, Bungo River (*Barns*), ix–x.1928, 4400 ft, BM slide no. 10244, in BMNH.

Paratypes. Angola: 4 ♂, 1 ♀, data as type; 4 ♂, Upper Cubango, Cunene Watershed (*Barns*), x–xi.1928, 5500 ft.

Material not included in the type-series. Democratic Republic of the Congo: 1 ♂, Elisabethville (*Seydel*), xi.1950, in CMP; 1 ♂, Lualaba, Lubudi (*Clair*), in MRAC; Kenya: 1 ♂, Kitale (*Howard*), v.1953; Tanzania: 1 ♂, Amani, x.1964 (*Pringle*).

Chrysotypus tessellatus (Warren) comb. n.

(Pl. 3, fig. 3; Pl. 26, fig. 137; Pl. 49, figs 279, 280)

Proterozeuxis tessellata Warren, 1908 : 346.
Proterozeuxis tessellata Warren; Dalle Torre, 1914 : 38.
Proterozeuxis tessellata Warren; Gaede, 1917 : 372 (incorrectly attributed to Hampson).
Proterozeuxis tessellata Warren; Gaede, 1929 : 497.

♂. Wing, 16–19 mm. Vertex brown, irrorate with white scales. Frons brown, flattened between eyes, clypeus slightly bulbous. Antennae strongly bipectinate with long, narrow pectinations. Proboscis reduced. Labial palps with third segment ½ length of second segment. Patagia brown. Thorax light brown, irrorate with white. Hind tibia with 2 pairs of spurs, outer spur of distal pair slightly shorter than inner, proximal pair usually well covered with scales (not visible until descaled). Abdomen brown, with white scales along posterior edge of tergites. Fore wing, pattern as in Pl. 3, fig. 3, white, heavily reticulated with brown. Prominent black discal spot, variable in outline, sometimes with light coloured centre, sometimes Y-shaped. Veins R_4 and R_5 anastomosing. Underside colour and pattern as upper side. Hind wings, colour and pattern as fore wing, black mark at apex of cell variable in size.

GENITALIA ♂ (Pl. 26, fig. 137). Gnathus reduced to two small lateral lobes. Juxta with two lateral lobes and two broad, chitinized, processes at 90° to lateral lobes. Transtilla incomplete.

♀. Wing 21 mm. Colour and pattern as male. Antennae minutely ciliate. Labial palps with third segment slightly more than 1/3 length of second segment.

GENITALIA ♀ (Pl. 49, figs 279, 280). Ostium broad, sclerotized, lightly spined.

DISCUSSION. There is relatively little variation in pattern or colour in the specimens examined. The light coloured wings of this species make it easy to distinguish from other species of the genus. Unlike the previous species there is strong sexual dimorphism in the shape of the antennae.

DISTRIBUTION. Map 3. Democratic Republic of the Congo; Tanzania; Malawi; Zambia.

MATERIAL EXAMINED.

LECTOTYPE ♂, here designated, MALAWI: Kasangazi, near Bandawe, 3000 ft above Lake Nyassa (*Prentice*), BM slide no. 9602, in BMNH.

Paralectotype, 1 ♂, MALAWI, data as lectotype.

DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Elisabethville (*Seydel*), in MRAC; 3 ♂, Elisabethville (*Seydel*), in CMP; 1 ♀, Elisabethville (*Seydel*); 1 ♂, Samafwanda; TANZANIA: 1 ♂, Chunya Distr., Chunya, 2650 ft, 28.xii.1947 (*Swynnerton*); MALAWI: 1 ♂, Livingstonia (*Wood*), in NMR; ZAMBIA: 1 ♂, Kitwe, xii.1954 (*Kruger*), in TMP.

Chrysotypus circumfuscus sp. n.

(Pl. 3, fig. 4; Pl. 26, fig. 138; Pl. 48, figs 277, 278)

♂. Wing 18–20 mm. Vertex dark brown with a few white scales, frons brown, clypeus not swollen. Antennae strongly pectinate. Labial palps with third segment 1/3 length of second, upturned, not reaching vertex. Proboscis reduced. Patagium brown, irrorate with white scales. Thorax brown with a few white scales. Abdomen brown, white scales laterally on tergum, white on sternum. Hind tibia with one pair of spurs distally, outer spur slightly shorter than inner spur. Fore wing, pattern as in Pl. 3, fig. 4, dark brown with darker brown markings, margins of wing brown, very dark brown, almost black, discal spot. Veins R_3 and R_4 with common stalk. Hind wing, colour and pattern as fore wing. Vein $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 26, fig. 138). Gnathus reduced to two small lateral lobes. Lateral arms of juxta 2/3 width of valve.

♀. Wing, 24–27·5 mm. Colour and pattern as male. Antennae bipectinate, pectinations shorter than male. Labial palps as in male.

GENITALIA ♀ (Pl. 48, figs 277, 278). Duct of bursa with broad neck.

DISCUSSION. This species is part of the closely allied species-complex containing

tessellatus, *luteofuscus* and *reticulatus*. It can be distinguished from these by the anastomosis of R_3 and R_4 in the fore wing (R_4 and R_5 anastomose in the other species), and in the male genitalia by the very long median juxta lobes 2/3 width of valve (1/2 or less in the other species). The specimen from Bwamba, Uganda, represents the western limit of the species in the main tropical rain-forest belt. From the males of most other species of the genus, *C. circumfuscus* can be distinguished by the very acute apex to the posterior edge of the hind wing. There is considerable variation in the reduction of the proximal pair of spurs in different specimens. In most of the male specimens the spurs appear to be absent (being hidden by the scale cover), in some specimens they are just visible but in the females from Ghana and the Congo, both pairs of spurs are visible. The wing venation and other characters of these specimens are typical of the species.

DISTRIBUTION. Map 3. Guinea; Sierra Leone; Nigeria; Liberia; Ghana; Democratic Republic of the Congo; Uganda.

MATERIAL EXAMINED.

Holotype ♂, UGANDA: Bwamba (*Carcasson*), vi. 1956, BM slide no. 10222, in BMNH.

Paratypes. SIERRA LEONE: 1 ♂, Njala, viii.1930 (*Hargreaves*); 3 ♀, Bo (*Revell*) vi.1967; LIBERIA: 5 ♂, Harbel, Marshall Terr. (*Fox*), 1956–57, four ♂ in CMP; NIGERIA: 1 ♂, Ibadan, Jericho (*Riley*), 1960; GHANA: 1 ♂ (*Bowden*); UGANDA: 1 ♀, Bwamba Forest, 2400 ft, Fort Portal, iv.1951 (*Pinhey*).

Material not included in the type-series. GUINEA: 2 ♂, 2 ♀ (*Mrázek*), in MMB; GHANA: 1 ♀, Kumasi, III.1949; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♀ Stanleyville (*Vermeulen*), in MRAC; REPUBLIC OF THE CONGO: 1 ♀, Brazzaville, Kindamba, Meya, by light, xi.1963 (*Endrody-Younga*), in HNHM.

Chrysotypus dives Butler

Chrysotypus dives Butler, 1879 : 241.
Chrysotypus dives Butler; Whalley, 1967 : 6, figs 1, 2, 36, 77.

DISTRIBUTION. Madagascar. Map 1.

Chrysotypus cupreus Kenrich

Chrysotypus cupreus Kenrich, 1914 : 589.
Chrysotypus cupreus Kenrich; Whalley, 1967 : 8, figs 3, 37.

DISTRIBUTION. Madagascar. Map 24.

Chrysotypus caryophyllae Frappa

Chrysotypus caryophyllae Frappa, 1954 : 350.
Chrysotypus caryophyllae Frappa; Whalley, 1967 : 9, figs 4, 40, 78.

DISTRIBUTION. Madagascar. Map 5.

Chrysotypus reticulatus sp. n.

(Pl. 3, fig. 5, Pl. 26, fig. 139, Pl. 49, figs 283, 284)

♂. Wing, 19–20 mm. Vertex and frons dark brown, clypeus not swollen. Antennae strongly pectinate. Labial palps with third segment 1/3 length of second, porrect, not reaching vertex. Proboscis reduced. Patagium brown. Thorax brown, irrorate with white scales. Hind tibia with two pairs of spurs, outer spur of distal pair slightly shorter than inner. Fore wing, pattern as in Pl. 3, fig. 5, yellowish brown with darker brown reticulations. Prominent dark brown discal spot. Vein R_4 and R_5 anastomosing (in some specimens only approximating). Hind wing with $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 26, fig. 139). Juxta lobes 1/2 width of valve.

♀. Wing, 22–25 mm. Colour and pattern similar to male but antennal pectinations shorter. Third segment of labial palps 1/3 length of second.

GENITALIA ♀ (Pl. 49, figs 283, 284). Similar to *C. circumfuscus* but ostium narrower.

DISCUSSION. This species differs from *C. circumfuscus* in the venation of the fore wing and in the shape of the juxta in the male. It also has two pairs of tibial spurs on the hind leg, whereas the proximal pair is reduced or absent in *circumfuscus*.

Little material of *C. reticulatus* is available but it appears to be the east and central African replacement of *C. circumfuscus*. The single specimen from Uganda differs in the shape of the juxta and the shape of the median process of the valve. It may represent a distinct species but these structures vary in shape to such an extent that more material is needed to confirm this. The venation of this specimen is typical of the other specimens of *reticulatus*.

DISTRIBUTION. Map 4. Uganda; Tanzania; Zambia; Rhodesia; Botswana; South West Africa; South Africa.

MATERIAL EXAMINED.

Holotype ♂, TANZANIA: Nachingwea, iv.1961 (*Bigger*), BM slide no. 10234, in BMNH.

Paratypes. TANZANIA: 1 ♀, Mikumi, 1720 ft, Morogoro Distr., ii–iii.1963 (*Marsh*); ZAMBIA: 1 ♂, Lusaka, 9.xii.1960, in NMR.

Material not included in the type-series. UGANDA: 1 ♂, Jinja, Mabira Forest, x.1962 (*Carcasson*), in NMK; RHODESIA: 1 ♀, Matabeleland, Khami, xii.1959, in NMR; 1 ♂, Wankie, v.1926 (*Tyler*), in TMP; TANZANIA: 1 ♂, Ilonga, ii.1966 (*Robertson*); BOTSWANA: 1 ♀, Sepopa, Ngamiland, ii.1967; SOUTH WEST AFRICA: 1 ♂, Okahanja, xii.1920 (*Bradfeld*); SOUTH AFRICA: 1 ♂, Sikora, vii.1922 (*van Dam*), in TMP; 1 ♂, Griffin Mine, i.1915 (*Breijer*), in TMP.

Chrysotypus subflavus sp. n.

(Pl. 2, fig. I; Pl. 26, fig. 140)

♂. Wing, 14·5–16 mm. Vertex yellowish brown, frons similar, clypeus slightly swollen. Antennae strongly bipectinate. Labial palps with third segment 1/3 length of second, upturned, not reaching vertex. Proboscis very small. Patagium and thorax yellowish brown. Hind tibia with two pairs of spurs, distal pair almost equal in length, apices of spurs pointed and sclerotized. Fore wing, pattern as in Pl. 2, I, pale sandy brown with darker costal margin and triangular dark mark in distal area. Reticulations lightly marked. Veins R_4 and R_5

anastomosing. Hind wing, pale sandy brown, reticulations lightly marked. Underside pale yellow.

GENITALIA ♂ (Pl. 26, fig. 140). Median process on valve pointed. Median juxta arms broad. Lateral process on aedeagus pointed.

♀. Unknown.

DISCUSSION. This is one of the most distinctively coloured of the African Chrysotypids. The pattern is greatly reduced and the very pale sandy colour is quite different from the brown of other Chrysotypids. Morphologically this species is close to *C. reticulatus*. At present *C. subflavus* is known from only one locality but was collected over several years and at different times of year.

DISTRIBUTION. Map 24. South West Africa.

MATERIAL EXAMINED.

Holotype ♂, SOUTH WEST AFRICA: Abachaus [160 ml N. of Windhoek], iii.1945 (*Hobohm*), BM slide no. 10227, in TMP.

Paratypes. SOUTH WEST AFRICA: 1 ♂, Abachaus, iv.1943 (*Hobohm*), in TMP; 1 ♂, Abachaus, xi.1944 (*Hobohm*); 1 ♂, Abachaus, iii.1944 (*Hobohm*), in TMP; 1 ♂, i.1946 (*Hobohm*); 1 ♂, Abachaus (*Hobohm*), xii.1949.

Chrysotypus luteofuscus sp. n.

(Pl. 3, fig. 6; Pl. 27, fig. 141)

♂. Wing, 17–19 mm. Vertex white, irrorate with brown. Base of antennae white, frons with white scales laterally, clypeus not swollen. Antennae strongly bipectinate. Labial palps with third segment 1/3 length of second, upturned, not reaching vertex. Proboscis small. Patagium golden brown, irrorate with white. White scales distally on each leg segment. Hind tibia with scale crest on posterior margin and with two pairs of spurs. Fore wing, pattern as in Pl. 3, fig. 6, translucent yellow-brown, with darker brown fascia. Basal area of fore wing brown, costal margin with white scales along length. Vein R_4 and R_5 anastomosing. Hind wing, colour and pattern as fore wing, $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 27, fig. 141). Juxta lobe 1/2–2/3 width of valve. Lateral process of aedeagus slightly bifurcate.

♀. Unknown.

DISCUSSION. This species can be separated from the other African Chrysotypids by the wing pattern. The amount of reticulation of wing pattern is less than in most other species in the genus. The slight bifurcation of the lateral process of the aedeagus seems characteristic. This species shows a further specialization in pattern as shown by the series *splendidus—reticulatus—circumfuscus* where the pattern tends to concentrate and the amount of reticulation to be reduced.

DISTRIBUTION. Map 24. Ivory Coast; Cameroon; Democratic Republic of the Congo; Gabon.

MATERIAL EXAMINED.

Holotype ♂, GABON: Belinga, 600 m, Camp Centrale, 25.iii.1963 (*Bernardi*), in MNHN.

Paratypes. IVORY COAST: 1 ♂ Makta, vi.1964 (*Griveaud*); DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Uele, Paulis, 28.iii.1957 (*Fontaine*), in MRAC; CAMEROON: 1 ♂, Efulen (*Weber*).

Chrysotypus splendidus (Warren)

(Pl. 4, figs 7, 8; Pl. 27, fig. 142; Pl. 48, fig. 276)

Proterozeuxis splendida Warren, 1899a : 7.
Proterozeuxis splendida Warren; Dalle Torre, 1914 : 38.
Proterozeuxis splendida Warren; Gaede, 1917 : 372.
Proterozeuxis splendida Warren; Gaede, 1929 : 497.
Chrysotypus splendida (Warren) Whalley, 1964a : 118.

♂. Wing, 13–19 mm. Vertex brown irrorate with white. Frons light brown, clypeus distinctly swollen. Antennae strongly bipectinate, with long narrow pectinations. Proboscis small. Labial palps with third segment 1/3 length of second, upturned, reaching vertex. Thorax brown, irrorate with white. Hind tibia with two pairs of spurs, outer spur of distal pair slightly longer than inner one, proximal pair protruding well beyond scale cover of tibia. Apices of spurs strongly sclerotized. Fore wing, pattern as in Pl. 4, fig. 7, brown with dark brown reticulations, fringe and costal margin brown. Veins R_4 and R_5 anastomosing. Hind wing, pattern and colour as fore wing. Veins $Sc+R_1$ and Rs not joining.

GENITALIA ♂ (Pl. 27, fig. 142). Median arm of juxta pointed with a few small hairs, lateral arms strap-like and enlarged.

♀. Wing, 21·5–23 mm (Pl. 4, fig. 8). Colour and pattern as male. Antennae minutely ciliate. Labial palps with third segment 1/2 length of second.

GENITALIA ♀ (Pl. 48, fig. 276). Neck of bursa covered with minute spines, number of spines varying in different specimens.

DISCUSSION. There are two distinct series of this species. One has the fringes brown, a few white scales on the wing and generally a yellowish brown ground colour, the other has a white fringe to the wings, white costal margin to the fore wing and a rather darker brown colouration. In the external morphology and the genitalia there is no difference between these two series. The two series are constant in colouration but the pattern within each series is variable. There is a high percentage of specimens with asymmetry in the pattern between left and right wings in both series. Both series occur in the same localities and may be seasonal forms, but the data at present available is inadequate to prove this. Some of the smaller male specimens were collected in South Africa, these are darker in colour than the dark-fringed series but still have the brown (not white) fringes. Strong sexual dimorphism of antennae occurs in this species. Some of the Ugandan specimens vary in the form of the reticulate pattern on the wings.

DISTRIBUTION. Map 5. Uganda; Mozambique; Rhodesia; Angola; Botswana; South Africa.

MATERIAL EXAMINED.

Holotype ♂, SOUTH AFRICA: Natal (*Spiller*), BM slide no. 8299, in BMNH.

UGANDA: 1 ♀, near Mt Elgon; 2 ♂, Murchison Falls, Paraa, iii–iv.1967 (*Schaaf*); MOZAMBIQUE: 1 ♂, Chiluvo, 4.iv.1966 (*Cookson*); RHODESIA: 2 ♂, Marandellas, xii.1960, one ♂ in NMR; 1 ♂, Umtali, 25.ii.1943 (*Carcasson*), in NMK; 1 ♂, Wankie, ii.1925 (*Tyler*), in TMP; 1 ♂, Umvuma, 18.i.1918 (*Carnegie*), in NMR; 1 ♂, Umvuma, xii.1918 (*Carnegie*), in NMR; 1 ♂, Shangani, xi.1919 (*Chambers*), in NMR; ANGOLA: 1 ♂, N'Dalla Tando, 1908 (*Ansorge*), 2700 ft; BOTSWANA: 1 ♂, 8 miles north of Maun, 8.ii.1967, in NMR; 1 ♂, Makala-ma-Bedi, Botletle River, 6.ii.1967, in NMR; 1 ♂, Thamalakani River, Maun, 7.ii.1967, in NMR; SOUTH AFRICA: Natal (*Leigh*), 1900;

1 ♂, Natal (*Hawick*), i.1905; 1 ♀, Mfongosi, Zululand (*Jones*), v.1911, in CT; 3 ♂, 2 ♀, Durban (*Leigh*); 1 ♂, Natal, Muden, x.1953 (*Cookson*), in NMK; 5 ♂, Natal, Muden, ii.1954 (*Cookson*), in TMP; 1 ♂, Natal, Muden, i.1954 (*Cookson*), in TMP; 1 ♂, Natal, Muden iii.1954 (*Cookson*), in TMP; 1 ♂, 1 ♀, Natal, Umkomaas, 14.i.1914 (*Janse*), in TMP; 1 ♂, Natal, Umkomaas, 8.ii.1913 (*Hargreaves*); 1♂, Natal, Sarnia, 10.ii.1912 (*Williamson*), in TMP; 1 ♂, Natal Coast, xii.1912 (*Hargreaves*); 1 ♂, Karkloof, N.P., 13–19.xii.1930 (*Janse*), in TMP; 2 ♂ Griffin Mine, i.1915 (*Breijer*), in TMP; 1 ♂, Skukuza, KNP survey, 10–13.ii.1963 (*Vari*); 1 ♂, Woodbridge, iv.1915 (*Swierstra*), in TMP; 2 ♂, Pretoria (*Janse*), one ♂ in TMP; 1 ♂, Pretoria North, 22.ii.1937 (*van Son*); 1 ♂, Pretoria North, 22.i.1917 (*Swierstra*); 1 ♀, Pretoria, 29.ii.1910 (*Gunning*); 1 ♀, Port St. John, Pondoland, xii.1923 (*Turner*); 1 ♀, Mt Edgecombe, Natal, 1953 (*Cookson*), in TMP; 1 ♀, Johannesburg, i.1949 (*Capener*), in TMP; 1 ♂, Barberton, i.1913 (*Williams*), in TMP.

Chrysotypus vittiferalis (Gaede) **comb. n.**

(Pl. 4, fig. 9; Pl. 27, fig. 144; Pl. 49, figs 281, 282)

Proterozeuxis vittiferalis Gaede, 1917 : 380.
Proterozeuxis medjensis Holland, 1920 : 325 (Syn. by Gaede, 1929 : 497).
Proterozeuxis vittiferalis Gaede, 1929 : 497.

♂. Wing, 20–22 mm. Vertex and frons dark brown, frons with scales produced into conical tuft, clypeus produced into small blunt cone. Proboscis small. Antennae strongly pectinate. Labial palps with third segment 1/3 length of second. Thorax dark brown. Hind tibia with two pairs of spurs, proximal pair very reduced, not visible through scales. Abdomen brown, lighter coloured on posterior margin of first few tergites. Fore wing, pattern as in Pl. 4, fig. 9, yellowish brown with heavy, dark brown reticulations. Veins R_4 and R_5 with common stalk. Underside, pattern similar, paler. Hind wing, $Sc+R_1$ and Rs free. Pattern and colour as fore wing.

GENITALIA ♂ (Pl. 27, fig. 144). Prominent gnathus arms. Transtilla incomplete. Juxta with two small lateral lobes and two widely expanded lobes at 90° to lateral lobes.

♀. Wing, 22·5 mm. Pattern as in male but less strongly marked reticulations. Antennae bipectinate, pectinations shorter than in male.

GENITALIA ♀ (Pl. 49, figs 281, 282). Ostium broad, lightly covered with spines.

DISCUSSION. The female specimens from the Cameroon are only tentatively associated with this species, their pattern is much lighter than in the male but this may be sexual dimorphism. The female genitalia are similar to those of *splendidus* but the wing pattern is distinct. The antennal pectinations in the male are very long, the longest being 10 × as long as broad. In the female (if correctly associated) they are only 4 × or 5 × as long as broad.

DISTRIBUTION. Map 5. Ghana; Cameroon; Democratic Republic of the Congo; Sudan; Kenya.

MATERIAL EXAMINED.

Holotype ♂ (*vittiferalis*), KENYA: Kwa Mumiji, BM slide no. 9639, in ZMB. Holotype ♂ (*medjensis*). DEMOCRATIC REPUBLIC OF THE CONGO; holotype not examined; drawing of genitalia examined and specimens compared with type by Dr F. Rindge. Type in AMNH.

GHANA: 2 ♂, N. Territories, Kete-Krachi (*Cardinall*); CAMEROON: 2 ♀, Efulen (*Weber*), one ♀ in CMP; SUDAN: 4 ♂, Tambura, Bahr-el-Ghazal.

Chrysotypus perineti Viette

Chrysotypus perineti Viette, 1957 : 171.
Chrysotypus perineti Viette; Whalley, 1967 : 11, figs 7, 39.

DISTRIBUTION. Madagascar. Map 4.

Chrysotypus animulus Viette

Chrysotypus animula Viette, 1957 : 173.
Chrysotypus animula Viette; Whalley, 1967 : 13, figs 8, 38.

DISTRIBUTION. Madagascar. Map 2.

Additional material. MADAGASCAR: 1 ♂, Station Perinet, Tananarivo (*Olsoufieff*).

Chrysotypus lakato Viette

Chrysotypus lakato Viette, 1958 : 206.
Chrysotypus lakato Viette; Whalley, 1967 : 12, figs 10, 80.

DISTRIBUTION. Madagascar. Map 3.

Chrysotypus maculatus Viette

Chrysotypus maculatus Viette, 1960 : 68.
Chrysotypus maculatus Viette; Whalley, 1967 : 14, figs 6, 79.

DISTRIBUTION. Madagascar. Map 24.

Chrysotypus phoebus Viette

Chrysotypus phoebus Viette, 1960 : 68.
Chrysotypus phoebus Viette; Whalley, 1967 : 15, figs 5, 81.

DISTRIBUTION. Madagascar. Map 2.

Chrysotypus locuples (Mabille)

Endagria locuples Mabille, 1879 : 134.
Chrysotypus locuples (Mabille) Whalley, 1967 : 15, figs 12, 41, 82.

DISTRIBUTION. Madagascar. Map 4.

NEOCHRYSOTYPUS gen. n.

Type-species: *Neochrysotypus cerussus* sp. n.

This genus is unique in the development of the two long arms of the transtilla which are sclerotized and project posteriorly. The genus is allied to *Chrysotypus*,

with which it shares a number of characters (broad valve with median process, aedeagus with lateral process). The female of *Neochrysotypus* is unknown but will probably have a highly modified anal papilla if the generic relationship with *Chrysotypus* is correct. Only two species of *Neochrysotypus* are known and the genus is restricted to the mainland of Africa.

Generic description. Proboscis reduced. Antennae ciliate or minutely ciliate. Labial palps with three segments. Fore wing with R_4+R_5 coming off common stem of $R_3+R_4+R_5$. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Tarsi without spines. Uncus simple. Gnathus lightly sclerotized or absent. Transtilla and base of costal margin of valve highly modified. Aedeagus with lateral process. Valve broad, with median process in more subapical position.

♀. Unknown.

Biology: No information.

Key to African species of *NEOCHRYSOTYPUS*

1 Fore and hind wings with distinct reticulate pattern (Pl. 4, fig. 10). Male genitalia with narrow median process on valve and slender posterior projection of transtilla (Pl. 27, fig. 143) . . . . **cerussus** (p. 46)

– Fore and hind wings with distinct transverse markings but not strongly reticulate. (Pl. 23, fig. 121) Male genitalia with broad median process on valve and broad posterior extensions of transtilla (Pl. 27, fig. 145) . . . **mysticus** (p. 47)

Neochrysotypus cerussus **sp. n.**

(Pl. 4, fig. 10; Pl. 27, fig. 143)

♂. Wing, 14·5 mm. Vertex white. Antennae minutely ciliate. Frons flattened between eyes. Proboscis small. Labial palps upturned, not reaching vertex, third segment 1/3 length of second. Thorax white. Hind tibia with two pairs of spurs. One spur of proximal pair very reduced, not visible through scales. Fore wing, pattern as in Pl. 4, fig. 10, translucent white with brown reticulations and brown mark over apex of cell. Underside similar. Veins R_4 and R_5 joined, coming off common stalk of $R_3+R_4+R_5$, vein R_2 approaches closely and in places touches this common stalk. Hind wing, colour and pattern as fore wing. Conspicuous brown spot at apex of cell. Veins $Sc+R_1$ and *Rs* free.

Genitalia ♂ (Pl. 27, fig. 143). Uncus short, blunt-ended. Gnathus absent. Valves broad, median process on each valve clavate, reaching almost to apex of valve. Basal part of valve strongly sclerotized and toothed. Basal part of costal margin of valve and transtilla highly modified, extending posteriorly into two strongly sclerotized, pointed arms. Juxta, two lightly sclerotized lobes. Aedeagus distinctly bifid, manica minutely spined.

♀. Unknown.

Discussion. The two specimens of this species, collected at the same time, differ in intensity of the dark reticulation. The second specimen also differs from the holotype in having both proximal spurs on the hind tibia well developed. The most remarkable structure in the male genitalia is the enormous development of the transtilla. This, at first sight, looks like a modified gnathus but is clearly from the transtilla. Although this is an unusual modification it is also found in *Neochrysotypus mysticus*. Most of the other morphological structures are similar to the more typical Chrysotypids. Externally this species is similar to *N. nivosa* but can

be separated from this by the prominent brown spot at the apex of the cell in the hind wing of *cerussus*, and the genitalia are quite distinct. From *N. mysticus*, to which it is most closely related, it can be separated by the structure of the male genitalia.

DISTRIBUTION. Map 4. Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♂, DEMOCRATIC REPUBLIC OF THE CONGO: Prov. Orientale, Opala, Lomami R., iii.1959 (*Carcasson*), BM slide no. 10481, in BMNH.

Paratype. DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, data as holotype.

Neochrysotypus mysticus sp. n.

(Pl. 23, fig. 121, Pl. 27, fig. 145)

♂. Wing, 15 mm. Vertex white. Antennae minutely ciliate. Proboscis very small. Labial palps upturned, not reaching vertex, third segment 1/3 length of second. Thorax brown. Hind tibia with two pairs of spurs, outer spur of distal pair half length of inner. Fore wing, pattern as in Pl. 23, fig. 121, translucent white with black and yellowish brown transverse reticulations. Underside similar. Vein R_4 and R_5 joined, coming out of common stem of $R_3+R_4+R_5$. Hind wing, as fore wing. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 27, fig. 145). Uncus short, pointed. Gnathus lightly sclerotized. Basal part of costal margin of valve and transtilla sclerotized and modified, extending posteriorly as two sclerotized arms. Valve broad, with prominent median process, slightly subterminal in position. Process sclerotized and slightly bifurcate. Juxta arms lightly sclerotized with two small basal lobes. Aedeagus with small lateral projection.

♀. Unknown.

DISCUSSION. Although only a single specimen of this species is known, it is sufficiently distinct from *N. cerussus* to be regarded as a good species. Externally the pattern is different, while in the genitalia the form of the uncus and the shape of the elongate transtilla separate *cerussus* from *mysticus*. This species is also described because it is only the second known species in the genus, which appears to be a development of *Chrysotypus*.

DISTRIBUTION. Map 4. Ivory Coast.

MATERIAL EXAMINED.

Holotype ♂, IVORY COAST: Adiopodoumé, ix.1963 (*Piart & Griveaud*), BM slide no. 10392, in MNHN.

PACHYTHYRINAE

The subfamily characters are given on p. 15. Only one genus of this subfamily is known from Africa.

DYSODIA Clemens

Dysodia Clemens, 1860 : 349. Type-species, *Dysodia oculatana* Clemens, by monotypy.
Dysodia Clemens; Whalley, 1964a : 119.
Dysodia Clemens; Whalley, 1968 : 3.

Since the publication of a revision of the African species of the genus (Whalley, 1968) additional material has been received. The additional information is incorporated in the following check-list of African species of the genus. For keys to

species and their synonymy, reference should be made to this earlier paper. One new species is described below (*D. parvita*). This species would key out in the fourth couplet together with *D. subsignata* and *D. lutescens* in the previously published key (Whalley, 1968 : 3). From both these species *D. parvita* can be separated by its smaller size (wing 8 mm, *parvita*; 10 mm or over, *lutescens* or *subsignata*).

The genus *Dysodia* is pantropical and is found on all continents except Australia. Although widespread in Africa and India the genus does not occur in Madagascar or the Seychelles. ("*Dysodia*" *calidella* Legrand, 1965, described from the Seychelles, was transferred to the Pyraustinae, Whalley, 1968 : 1).

Dysodia is a very distinctive genus with a characteristic external appearance. It is probably related to *Thyris* Laspeyres which also has the dorsal process on the tergum of the male genitalia, and other characters are common to both genera. Further examination of *Thyris* Laspeyres, *Hyperthyris* Leech, *Glanycus* Walker and *Gippius* Walker, all of which should be in the Pachythyrinae and comparison with *Dysodia* is needed.

Generic description. Labial palps three-segmented. Proboscis present. Eyes without interfacetal hairs. Hind tibia with two pairs of spurs. Fore tibia with epiphysis. Tarsi with rows of spines on each segment. Fore wing with some radial veins fused or from cell. Male with prominent process ("hump") on tergum of genitalia. Female with secondary sac on bursa.

Check-list of African *Dysodia* with notes supplementary to the paper by Whalley, 1968.

D. zelleri (Dewitz), 1881 : 65. Map 13. Angola; Sierra Leone; Nigeria; Cameroon; Uganda.

D. hamata Whalley, 1968 : 5. Map 13. Tanzania.

D. binoculata Warren, 1901b : 203. Map 14. South Africa. Pl. 23, fig. 124, text-fig. 6.

D. antennata Whalley, 1968 : 7. Map 15. South Africa.

D. fenestratella Warren, 1900 : 90. Pl. 1, K. Map 16. Uganda; Kenya; Tanzania; Rhodesia; South Africa.

D. constellata Warren, 1908 : 332. Pl. 1, J. Map 17. Malawi; Zambia; Rhodesia; Mozambique; South Africa.
Additional material. Zambia: 1 ♂, Abercorn, x.1966 (*IRLCS*), in NMR.

D. collinsi Whalley, 1968 : 8. Map 14. Nigeria; Cameroon; Gabon; Democratic Republic of the Congo.

D. vitrina vitrina (Boisduval), 1829 : 1, fig. 5. Pl. 1, H. Map 18. Sierra Leone; Guinea; Liberia; Ivory Coast; Ghana; Cameroon; Angola.

D. vitrina flammata Warren, 1904 : 461. Pl. 1, I. Map 18. Tanzania; Malawi; Rhodesia; Mozambique.

D. subsignata Warren, 1908 : 335. Map 19. Rhodesia; South West Africa; South Africa.

D. intermedia (Walker), 1865 : 827. Map 20. Senegal; Nigeria; Uganda; Tanzania; Kenya; Rhodesia; Zambia; Mozambique; South West Africa; South Africa.

Additional material. UGANDA: 2 ♂, Toro, Kibale Forest, v.1966 (*Carcasson*), in NMK; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Katanga, Kolwezi, i.1967 (*Allard*), in NMK; NIGERIA: 1 ♂, Ibadan, viii.1960 (*Caswell*), 2 ♀, Benue (*Brown*); SENEGAL: 2 ♂, 2 ♀, Sebikotane, x.1968 (*Berhaut*).

These additional specimens are as variable in pattern as those already described (Whalley, 1968 : 10) but the shape of the genitalia is similar. The possibility of subspeciation in this species is still to be resolved.

D. fumida Whalley, 1968 : 11. Map 15. Tanzania; Kenya; Rhodesia.

D. lutescens Whalley, 1968 : 11. Map 21. Tanzania; Kenya.

Additional material. TANZANIA: 13 ♂, Ilonga, ii–iii.1963 (*Robertson*). These specimens from Ilonga are more orange-yellow than the original series. This species has been bred from *Ritchiea* sp. (Capparidaceae) [D. G. Sevastopulo, *in litt.*].

D. crassa (Walker), 1865 : 827. Map 21. Zambia; South Africa.

No previous type-selection has been made for this species; I designate as LECTOTYPE the male labelled, S. AFRICA: Pt Natal, BM slide no. 8338, in BMNH.

D. magnifica Whalley, 1968 : 13. Map 22. Sierra Leone; Ivory Coast; Democratic Republic of the Congo; Uganda; Kenya.

Additional material, KENYA: 1 ♂, Kakamega, x.1966 (*Carcasson & Forbes-Watson*); 1 ♀, Kakamega, xii.1966 (*Carcasson & Forbes-Watson*); 1 ♂, Kakamega, iii.1966 (*Carcasson & Forbes-Watson*) in NMK; SIERRA LEONE: 2 ♂, Bo, vi.1967 (*Revell*).

The female of this species (Pl. 5, fig. 15) was not known when the original description was made. It is similar in colour and pattern to the male. Wing, 19 mm. The genitalia (Pl. 50, figs 285, 286) are similar to those of *D. incognita* and *D. subsignata*. It can be separated from these species by the much stronger sclerotization round the ostium, less tightly convolute duct and much larger signum. Apart from being the first female of *D. magnifica*, the specimen from Kenya is only the second female specimen of the three species in the *magnifica*-group. When this species-group was described, the single female of *D. incognita* was only doubtfully associated with that species (Whalley, 1968 : 14), partly because of its close similarity to the female of *D. subsignata* with which the adult might be confused on pattern and partly because this single female was not from the type locality. However, in the case of the female of *D. magnifica*, the size and pattern agree with the male specimen collected at the same time and in the same locality, this male is indistinguishable from the holotype. The genitalia of the female *incognita* and the female *subsignata* could only be separated with difficulty and this added to the doubt of the correct association of the female *incognita*. Now that the female of *magnifica* is known and the genitalia are similar to the female of *incognita* there is less doubt of the correctness of this association. With two of the species in the *magnifica*-group with such similar female genitalia and the similarity between these and the female of the *subsignata*-group, the affinities between these species are of particular interest. The males of the *magnifica*-group and *subsignata*-group are quite different (Whalley, 1968 : 13) and the discovery of the female of the third species (*amani*) in the *magnifica*-group will be of interest. The two male specimens from Sierra Leone

differ from the holotype from Uganda in the shape of the enlarged basal part of the gnathus at the junction with the tegumen. In the holotype this part has elongate points on either side, whereas in the specimens from Sierra Leone these points are absent. Until more material of this species is available the significance of this difference is not known but is probably subspecific. A similar difference between the holotype and a specimen from Ivory Coast was noted in the original description.

D. incognita Whalley, 1968 : 14. Map 23. Tanzania; Rhodesia; South West Africa.

D. amani Whalley, 1968 : 14. Map 22. Tanzania.

One new species has been found since the publication of the revision of *Dysodia* in Africa (Whalley, 1968), this is described below.

Dysodia parvita sp. n.

(Pl. 4, figs 11, 12; Pl. 27, fig. 146)

♂. Wing, 8 mm. Vertex yellowish brown. Antennae shortly dentate. Proboscis reduced. Labial palps with third segment 1/3 length of second, upturned, not reaching vertex. Frons rounded, not projecting between eyes. Thorax orange-brown. Hind tibia with outer spur of distal pair 1/2 length of inner spur. Fore wing, pattern as in Pl. 4, figs 11, 12, orange-brown with reddish brown fringe and indistinct median brown fascia. Underside similar, median fascia consisting of anterior and posterior patch of brown, more distinct than on upper side. Radial veins from cell. Hind wing, colour and pattern as fore wing. $Sc+R_1$ and Rs free.

Genitalia ♂ (Pl. 27, fig. 146). Uncus long and slender. Gnathus arms lightly sclerotized, not meeting in mid-line. Valves simple, lightly sclerotized, sinuous sacculus process. Juxta, two flattened lateral lobes. Saccus reduced. Aedeagus with minutely spined vesica.

♀. Unknown.

Discussion. This is the smallest species in the genus and can be separated from all the others by its size. The dorsal process on the tergum of the genitalia is not as large as in the other species and there are fewer spines on the tarsi than in some of the other species of *Dysodia*. Until a female of this species is found it is difficult to give the exact relationship of the species in the genus. The "simple" genitalia show that the species is far removed from the *magnifica*-group and the actual placing of *parvita* in a species-group is difficult. Tentatively it is placed in the *subsignata*-group, mainly on the similarity of the antennae to species in that group. There is considerable variation in the series of *parvita* examined, several of them being more heavily patterned and with a darker transverse fascia than the type.

Distribution. Map 23. S. Africa.

Material examined.

Holotype ♂, South Africa: Beit Bridge, 22.iv.1956 (*van Son & Vari*), BM slide no. 10053, in TMP.

Paratypes. South Africa: 1 ♂, data as type; 1 ♂, Nyandu Bush, KNP survey, 22.xi.1961 (*Vari & Rorke*), in TMP; 1 ♂, Punda Milia, KNP survey, 1–5.xii.1964 (*Vari & Potgieter*), in TMP; 1 ♂, Punda Milia, KNP survey, 9–11.xii.1963 (*Vari*); 1 ♂, Pafuri, ii.1961 (*Mockford*), in TMP.

STRIGLINAE

The characteristics of this subfamily are given on p. 15. The species in the genera of this subfamily are widespread; from Africa and Madagascar throughout the Indo-Pacific region and two of the genera have species in the Neotropical region. One of the distinctive features of species in this subfamily is the highly modified male genitalia.

MATHORIS Guenée

Mathoris Guenée, 1877 : 282. Type-species, *M. roseola* Felder & Rogenhofer, by subsequent designation, Whalley, 1964a: 122.
Mathoris Guenée; Pagenstecher, 1892 : 36.
Mathoris Guenée; Hampson, 1897 : 611.
Mathoris Guenée; Dalle Torre, 1914 : 9.
Mathoris Guenée; Gaede, 1917 : 374.
[*Heteroschista* sensu Gaede, 1917 : 374, nec Warren, 1903].
Mathoris Guenée; Gaede, 1929 : 497.
Mathoris Guenée; Whalley, 1964a : 122.

This genus contains only one species in Africa. Morphologically *Mathoris* is a very distinct genus, differing from all other genera in the family in the shape of the eye, which is flattened on the posterior margin in *Mathoris*, while being practically circular in all other genera. The African species differs from the type of the genus from S. America in the shape of the uncus in the male and in the shape of the ostium on the female. In spite of these differences the African and South American species share many common morphological features which suggest that the species may be closely related rather than that they show convergent resemblances. These features are also shared by *Mathoris ignepicta* Hampson (**comb. n.**) from India.

At present this genus consists of four species, all rather similar externally. Two species are from South America, one from India and one from Africa.

Generic description. Labial palps 3-segmented. Eyes flattened on posterior margin, slightly reniform, without interfacetal hairs. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Tarsi each with a pair of apical spines. Fore wing with R_2+R_3. Hind wing with $Sc+R_1$ and Rs joining for part of length. Male with well developed socii in the genitalia.

Biology. No information is available on the African species but in India, *M. ignepicta* has been bred from *Mimusops* (=*Manilkara*) *elengi* Adans (Sapotaceae) (these specimens are in BMNH). It is interesting that in the other Thyridid genus, *Banisia*, with species in Africa, America and India, the host plant is also a species of Sapotaceae.

Mathoris magica Gaede

(Pl. 5, figs 13, 14; Pl. 28, fig. 147, Pl. 50, fig. 287, Text-fig. 3)

Mathoris magica Gaede, 1917 : 381.
Mathoris magica Gaede; Gaede, 1929 : 497.

♂. Wing, 7·5–8 mm. Vertex black. Antennae minutely ciliate. Labial palps 3-segmented, third segment 1/4 length of second segment, upturned, just reaching vertex. Frons shortened, proboscis originating at front of head close below antennae. Eyes flattened on posterior margin and slightly reniform in some specimens (Text-fig. 3). Thorax black. Hind tibia thickened

with scales, outer spur of distal pair 1/2 length of inner spur, longest spur less than length of 1st hind tarsal segment. Fore wing, pattern as in Pl. 5, fig. 14, black with a few dark fascia. Underside with lighter fascia and distinct red colour along costal margin. Veins *1A* and *2A* forming an incomplete loop at base of wing, joining together near base and running separately to margin. Hind wing, colour as fore wing, two distinct red fascia on wing.

GENITALIA ♂ (Pl. 28, fig. 147). Uncus obscured in ventral view by development of socii as two forward projecting arms. Uncus only clearly visible in side or dorsal view as long sclerotized projection, articulating with a small raised boss. Gnathus a complicated double structure which cannot be separated from a possible sclerotization of the subscaphium. Juxta highly modified, "T"-shaped with dorsal lobe. Basal process with several sclerotized teeth. Valve simple, blunt-ended, and heavily scaled. Aedeagus with small group of cornuti.

♀. Wing, 7 mm. Colour and pattern as in male. Third segment of labial palps over 1/2 length of second.

GENITALIA ♀ (Pl. 50, fig. 287). Anal papilla short. Ostium with two sclerotized plates on either side. Sclerotized first part of duct narrow, minutely spined.

DISCUSSION. The genitalia of the male are very distinct from most other African Thyrididae. At present *M. magica* is the only known African species where the eyes are not spherical. While there are differences in the genitalia between *M. magica* and *M. roseola* Felder & Rogenhofer (the type-species of *Mathoris*) both species have similar fore and hind wing venation and other aspects of the morphology are very similar. The female of *M. roseola* has a very complicated ostium and in the male the uncus is reduced but the twin socii and modified gnathus found in *magica* are present in *roseola*. In some respects it would be possible to consider the two species as belonging to separate genera but the number of similar features make it preferable to indicate their possible relationship by keeping them in the same genus.

In the few specimens of *magica* examined, two specimens have more white in the basal and median areas (Pl. 5, fig. 13), otherwise the remaining specimens are very constant in their colouration.

DISTRIBUTION. (Map 25). Ghana; Cameroon; Rio Muni; Gabon; Uganda.

MATERIAL EXAMINED.

Holotype ♂, RIO MUNI: Benito Gebiet (*Tessmann*), BM slide no. 9675, in ZMB.

GHANA: 1 ♂, Kumasi, ii (*Sanders*); CAMEROON: 1 ♂, Metet, 10.iv.1918 (*Good*); 1 ♂ no data, probably Cameroon, in CMP; GABON: 2 ♂, Kangwe, including one ♂ in CMP; 1 ♂, Fernan Vaz, Lake Asebbe, i.1908 (*Ansorge*); UGANDA: 1 ♂, Kalinzu Forest (*Jackson*).

NEOBANISIA Whalley

Neobanisia Whalley, 1967 : 45. Type-species, *Striglina antiopa* Viette, by original designation.

This genus contains four African species, one Madagascan species and one species at present known only from Mauritius.

The present description modifies slightly the original description of the genus (Whalley, 1967 : 45) and may need some further modifications when species in other faunal regions are studied. *Neobanisia* is part of the complex of genera which includes *Banisia* Walker, *Canaea* Walker and *Striglina* Guenée. All these genera have rather complicated genitalia in both sexes compared with the relatively simple genitalia of other Thyridid genera. *Neobanisia* is related to *Canaea* but the female

of the latter genus have a secondary sac on the bursa which is absent in *Neobanisia* and there are other differences in the male. It is possible that *Neobanisia* may be regarded as a subgenus of *Canaea* but a decision on this will have to await a revision of the Oriental and Australian species of *Canaea.*

Generic description. Eyes without interfacetal hairs. Labial palps 3-segmented. Antennae minutely ciliate. Frenulum in female double or triple. Fore wing with radial veins from cell or some fusion of radials. Proboscis well developed. Fore tibia with epiphysis. Hind tibia with 2 pairs of spurs. Tarsi each with apical pair of spines. Male with simple or clavate uncus. Socii well developed. Usually some modification of base of sacculus, often spiny. Cornutus in aedeagus. Female with highly modified and sclerotized ostium.

Biology: No information.

Key to the African species of *NEOBANISIA*

1		Fore and hind wing colour black, often a small white spot on fore wing	***fuliginea*** (p. 53)
–		Brown or reddish brown species	2
2	(1)	Larger species, wing over 11 mm. Orange-brown, often either with a dark mark or translucent area in fore wing	4
–		Under 11 mm wing. Reddish or brown species	3
3	(2)	Reddish brown species, not heavily patterned, sometimes with small translucent area in fore wing	***inoptata*** (p. 56)
–		Brown species, patterned, with yellowish brown or white areas, often suffused with red	***zamia*** (p. 57)
4	(2)	Wing 11–14·5 mm. Generally reddish brown, male genitalia as in Pl. 28, fig. 148. Female genitalia as in Pl. 50, fig. 288	***joccatia*** (p. 54)
–		Wing, 13–18 mm. Males grey-brown. Females reddish brown. Male genitalia Pl. 28, fig. 149. Female genitalia Pl. 51, fig. 295	***clathrula*** (p. 55)

Neobanisia fuliginea sp. n.

(Pl. 5, fig. 16; Pl. 24, figs 127–129; Pl. 28, figs 151, 152; Pl. 50, figs 290, 291; Text-fig. 1)

♂. Wing, 10–10·5 mm. Vertex black, irrorate with white. Strongly sclerotized projection on frons in front of antennae, with sharply truncate, white end. Flat sclerotized "roof" above base of proboscis (Pl. 24, figs 127–129; Text-fig. 1). Antennae ciliate. Labial palps short, approximately equal to diameter of eye, third segment 1/3 length of second. Thorax black with white-tipped scales. Legs black, white scales in ring at end of tibia and each tarsal segment. Hind tibia with scale-tuft, outer spur of distal pair slightly more than 1/2 length of inner spur. Proximal inner spurs longer than distal ones. Fore wing, pattern as in Pl. 5, fig. 16, sooty black with dark ante- and post-median fascia, some black wing scales tipped with white. White spot behind cell. Underside paler, more white-tipped scales. Costal margins with darker patches, white spot clearer. R_1 approaches R_2 but does not join. R_3 and R_4 separated at origins by $2\times$ distance of R_4 from R_5. $1A$ and $2A$ join very near base to make single vein to wing margin. Hind wing, colour and pattern as fore wing, but without white median spot. $Sc+R_1$ and Rs almost touch for part of length.

Genitalia ♂ (Pl. 28, figs 151, 152). Uncus simple, slightly swollen at apex. Socii with long scales. Gnathus simple, no median projection. Basal part of sacculus covered with long spines. Juxta plate-like. Aedeagus with apical swelling, lightly sclerotized plate-like cornutus with teeth, strongly curved with prominent sclerotized projection near base, similar to species of *Chrysotypus*.

♀. Wing, 10·5–11·5 mm. Head, labial palps, colour and pattern as in male. Frenulum double.

Genitalia ♀ (Pl. 50, figs 290, 291). Anal papillae short. Ostium highly modified and sclerotized and enclosed partly in a capsule formed by the VIIIth segment. Central spiny process truncate, with two lateral sclerotized "wings" on each side. Anterior to the process are many small spines and one large spine on each side of the VIIIth segment. These spines may be broken off but the enlarged holes where they were inserted are always visible. Duct of bursa long, convulute. Bursa with signum consisting of large area of lightly sclerotized plates with two or more heavily sclerotized plates, strongly indented.

Discussion. The colour and pattern separate this species from any other African Thyridid. The male genitalia are typical of species of *Neobanisia* but the strongly spined base of the valve separates it from the others in the genus. Little variation in colour or pattern was found. *N. fuliginea* is closely allied to *N. inoptata* but can be distinguished by colour and pattern, the male of *inoptata* is unknown. The structure of the frons is shown in Text-fig. 1 andP l. 24, figs 127–129, this is unique in the African Thyrididae.

Distribution. Map 27. Ghana.

Material examined.

Holotype ♂, Ghana: N. Territories, Kete-Krachi (*Cardinall*), BM slide no. 10067, in BMNH.

Paratypes, Ghana: 7 ♂, 15 ♀, data as holotype.

Neobanisia joccatia sp. n.

(Pl. 6, fig. 22; Pl. 28, fig. 148; Pl. 50, figs 288, 289)

♂. Wing, 11·5–13 mm. Vertex grey-brown. Labial palps nearly 2 × diameter of eye, third segment 1/3 length of second. Frons with tuft of scales produced between eyes. Patagia grey-brown, rest of thorax orange-brown. Hind tibia with scale tuft, outer spur of distal pair less than 1/2 length of inner spur. Inner spur of distal pair long, almost equal to first hind tarsal segment. Fore wing, pattern as in Pl. 6, fig. 22, orange-brown with darker transverse fascia. Terminal margin with dark line, fringe with shorter scales red-tipped, longer scales brown. Basal area of wing paler. Underside paler, broad, slightly lilac tinged subterminal fascia, darker subapical area. Veins R_2 and R_3 with common stalk. Hind wing, pattern as fore wing but outer part of fringe white, underside paler. $Sc+R_1$ and Rs run together for part of length.

Genitalia ♂ (Pl. 28, fig. 148). Uncus simple, strongly angled and rather truncate. Socii well developed. Gnathus arms weakly sclerotized, not joining in mid-line. Valve simple, costal margin with sclerotized process at base, median basal process sclerotized. Juxta, a simple plate. Base of sacculus heavily spined. Aedeagus with small sclerotized cornutus covered with spines. Manica sclerotized and strongly toothed, apex of aedeagus with long, sclerotized, toothed plate.

♀. Wing, 12–14 mm. Colour and pattern as male. Labial palps 2 × diameter of eye. Frenulum triple.

Genitalia ♀ (Pl. 50, figs 288, 289). Anal papillae short. VIIIth segment sclerotized. Ostium strongly sclerotized and spiny with prominent lateral processes at edge of opening. Duct covered with minute spines, long, sinuous. Indistinct, lightly sclerotized, oval area of plates with small spines, forming signum.

Discussion. Externally this species is similar to *Banisia myrtea* Drury from India but the genitalia are distinct. The modification of the VIIIth segment round

the ostium is similar to *N. fuliginea* but *N. joccatia* can be distinguished from this species by size and colour. From *N. inoptata* it can also be separated by size and shape of the sclerotized part of the VIIIth segment. *N. joccatia* is a more orange-brown colour than the related *N. antiopa* Viette from Madagascar and the base of the sacculus of *antiopa* has a small sclerotized hook whereas *joccatia* has a large group of spines. Some variation exists in the colour and pattern of specimens of *N. joccatia*, particularly in the presence or absence of a translucent area in the fore wing, and in some specimens, a distinct, darker brown, median patch in the fore wing. Variation in the shape of the basal process of the male was also found. For separation from *N. clathrula* see page 56.

Distribution. Map 26. Rhodesia; Mozambique; South Africa.

Material examined.

Holotype ♂, South Africa: Three Sisters, 21.ii.1911 (*Janse*), BM slide no. 10052, in TMP.

Paratypes. South Africa: 1 ♂, 1 ♀, St Lucia Lake, N., x.1934 (*Bell Marley*), in TMP; 1 ♂, Durban, 2.xii.1923 (*Leigh*); 1 ♀, Natal, Pinetown, 1.iii.1910 (*Leigh*), in TMP; 1 ♀, Natal, Northdene.

Material not included in type-series. Rhodesia: 1 ♀, Vumba Mts, Umtali, ii.1961, in NMR; Mozambique: 1 ♀, Chibuto, 1919 (*Moreira*); South Africa: Tongaat, 1 ♀, 1908–09 (*Burnup*), in TMP.

Neobanisia clathrula (Guenée) sp. rev., comb. n.

(Pl. 5, figs 17, 18; Pl. 28, fig. 149; Pl. 51, figs 295, 296)

Striglina clathrula Guenée, 1877 : 285.
Striglina clathrula Guenée; Pagenstecher, 1892 : 39.
[*Rhodoneura myrtaea;* sensu Hampson, 1897 : 618, nec Drury, 1773.]
[*Rhodoneura myrtaea;* sensu Dalle Torre, 1914 : 28, nec Drury, 1773.]

♂. Wing, 13–17 mm. Vertex brown. Labial palps with third segment 1/3 length of second, upturned, reaching vertex, nearly 2× diameter of eye. Frons with tuft of scales produced between eyes. Patagia grey-brown, rest of thorax similar. Hind tibia with scale tuft. Outer spur of distal pair on hind tibia slightly more than 1/2 length of inner spur. Fore wing, pattern as in Pl. 5, fig. 17, grey-brown with prominent fenestrations. Radial veins from cell. Underside paler than upper, mauve coloured with some brown patches. Fenestrations prominent. Small white line over vein at apex of cell. Hind wing, colour and pattern as fore wing. Underside, as underside of fore wing.

Genitalia ♂ (Pl. 28, fig. 149). Uncus short. Socii very large. Gnathus absent. Prominent basal process. Juxta a narrow median plate. Aedeagus with sclerotized process at apex. Vesica minutely spined.

♀. Wing, 13–18 mm. Pattern as male but reddish brown colour instead of grey-brown. Frenulum triple.

Genitalia ♀ (Pl. 51, figs 295, 296). Plate round ostium strongly spined. Duct thickened in first part, rest of duct broad, minutely spined. Bursa minutely spined.

Discussion. This species was previously known from the female holotype only and the country of origin was unknown. Two of the specimens examined (a male and a female) match the pattern of the type-specimen. The other specimens are

similar to Pl. 5, fig. 18, and lack most of the fenestrations in the fore and hind wings, which are so characteristic of the holotype. There is no difference between the genitalia of these two forms and no differences can be seen from the data at present available on the possibility of seasonal forms. Both forms have been caught in the same month and in the same locality. This species is related to *N. joccatia* from the mainland of Africa. It can be separated from this species in the male by the shape of the basal process of the valve and in the female by the shape of the ostium. *N. clathrula* is generally larger than *N. joccatia* and has sexual dimorphism of colour, the male being grey-brown while the females are distinctly red-brown.

DISTRIBUTION. Map 26. Mauritius.

MATERIAL EXAMINED.

Holotype ♀, [MAURITIUS]: "Patrie inconnue, *Strigl. clathrula* Gn. Oberthur coll.", BM slide no. 8408, in BMNH.

MAURITIUS: 1 ♂, Mt Corps de Garde (*Carie*), xi.1898, in MHNH; 1 ♂, Curepipe (*Carie*), v.1900; 1 ♀, Curepipe, 1600 ft (*Tulloch*), vii.1900–iii.1901; 1 ♂, Curepipe (*Carie*), 18.vi.1902, in MNHN; 1 ♂, 1 ♀, Curepipe (*Carie*), iii.1905, in MNHN; 1 ♂, 1 ♀, Curepipe (*Carie*), v.1906, in MNHN; 1 ♀, Curepipe (*Carie*), 21.i.1911, in MNHN; 1 ♀, Curepipe (*Carie*), 9.ii.1912; 2 ♂, 1 ♀, Curepipe (*Carie*), x.1912, in MNHN; 1 ♀, Curepipe (*Carie*), 18.ii.1913; 1 ♀, Curepipe (*Carie*), 9.iii.1913; 1 ♂, Ile Maurice, in MNHN; 1 ♀, Macabé (*Vinson*), 28.i.1963, in MNHN.

Neobanisia inoptata **sp. n.**

(Pl. 1, G; Pl. 51, figs 292–294)

♀. Wing, 9–10 mm. Vertex brown, frons slightly produced between eyes. Labial palps slightly longer than diameter of eye, third segment more than 1/3 length of thorax. Thorax reddish brown. Hind tibia with outer spur of distal pair slightly more than 1/2 length of inner; proximal spurs longer than distal spurs. Fore wing, pattern as in Pl. 1, G, reddish brown with dark terminal margin, grey-white fringe and narrow, red, subterminal fascia. Rest of wing lightly marked with sinuous brown, transverse lines. Costal margin grey-brown. Frenulum double. Radial veins from cell. R_1 approaches R_2 but does not join it. R_3 and R_4 separated at base by $2\times$ distance of R_4 from R_5. Underside, subterminal brown mark and yellowish mark over apex of cell, ground colour paler than upper side but more strongly reticulate. Hind wing, colour and pattern as fore wing. $Sc+R_1$ and Rs approach closely but do not join. Underside with reddish mauve tinge and more heavily marked than upperside.

GENITALIA ♀ (Pl. 51, figs 292, 293, 294). Anal papillae short. Ostium sclerotized and spined. Posterior margin of last segment forms part of cover over heavily sclerotized part of ostium. Median spiny pad in centre of ostium with lightly sclerotized lateral arms. Anterior part of last segment heavily spined, with two large spines laterally. Duct long and strongly convolute, bursa with large sclerotized signum with more heavily sclerotized transverse bar on signum.

♂. Unknown.

DISCUSSION. The reddish brown colour with dark terminal margins and small size readily separate this species from all other African Thyridids. The genitalia and wing venation are similar to *fuliginea*, particularly in the presence in both species of the two large spines on the last abdominal segment, the shape of that segment and the shape of the signum. Although males of *inoptata* have not been found, the

pattern and genitalia are sufficiently distinct from *fuliginea* (which occurs in the same locality) for *inoptata* to be regarded as a distinct species. Some variation in colour occurs, mainly in the extent of the black terminal margins. In some specimens this extends nearly to the cell from the terminal margin of the fore wing. In a few specimens there is also a small translucent area in the fore wing.

DISTRIBUTION. Map 27. Ghana.

MATERIAL EXAMINED.
Holotype ♀. GHANA: N. Territories, Kete-Krachi (*Cardinall*), BM slide no. 10544, in BMNH.
Paratypes. GHANA: 6 ♀, data as holotype.

Neobanisia zamia sp. n.

(Pl. 6, figs 19, 20; Pl. 28, fig. 150)

♂. Wing, 9·5–10·5 mm. Vertex grey-brown. Labial palps 1½× diameter of eye, third segment 1/3 length of second. Tuft of scales on frons forming conical projection between eyes. Thorax grey-brown. Hind tibia with outer spur of distal pair 2/3 length of inner spur. Fore wing, pattern as in Pl. 6, fig. 19, brown with yellowish brown subterminal area and some yellow maculations in anterior part of median area, rest of maculations translucent. Basal area brown. Underside, as upperside, paler, black spots terminally between veins. Veins R_4 and R_5 with short common stalk. Hind wings, colour and pattern as fore wing, $Sc+R_1$ and Rs run close together but do not join.

GENITALIA ♂ (Pl. 28, fig. 150). Uncus simple, slightly clavate at tip. Socii enlarged. Gnathus arms lightly sclerotized. Valve simple, narrowing in apical half. Basal process toothed and heavily sclerotized, with median basal sclerotized part. Juxta a simple plate. Base of sacculus strongly toothed. Aedeagus curved, vesica with small teeth.

♀. Wing, 10 mm. Pattern as male. More reddish brown colour than male. Abdomen missing. Frenulum triple.

DISCUSSION: This species varies from reddish brown to yellow-brown, with one specimen from the Mariep Mts, South Africa (Pl. 6, fig. 20) lacking most of the yellow colour although having a strong reticulate pattern. The genitalia of all the specimens are, however, similar. This species can be separated from *N. joccatia* by its smaller size and by the narrowing of the valve of the male half way up to the apex. From *N. fuliginea* it can be separated by colour and the shape of the basal process in the male. In size, *N. zamia* is similar to *N. inoptata* but the pattern is quite different. In view of the variation, and the small number of specimens examined, only the specimens from near the type-locality are considered as paratypes.

DISTRIBUTION. Map 27. South Africa.

MATERIAL EXAMINED.
Holotype ♂, SOUTH AFRICA: Port St Johns, 24–30.xi.1956 (*van Son & Martin*), BM slide no. 10562, in TMP.
Paratypes. SOUTH AFRICA: 1 ♂, East London, iii.1947 (*Clarke*), in TMP, 1 ♀, data as type (abdomen missing).
Material not included in type-series. SOUTH AFRICA: 1 ♂, Marieps Mts, xii.1925 (*van Son*), in TMP; 1 ♂, Eshowe Forest (*Janse*), 26.x.1951.

Neobanisia antiopa (Viette)

Striglina antiopa Viette, 1954 : 120.
Neobanisia antiopa (Viette); Whalley, 1967 : 46, figs 19, 44, 68, 69.

DISTRIBUTION. Map 26. Madagascar.

BANISIA Walker

Banisia Walker, 1864 : 77. Type-species, *Banisia fenistrifera* Walker, by original designation.
Banisia Walker; Whalley, 1964a : 117.
Banisia Walker; Whalley, 1967 : 47.

This genus contains three species which are restricted to Africa and the Seychelles and a subspecies of an almost tropicopolitan species, *B. myrsusalis* Walker. The genus is structurally very distinct from other Thyridid genera and, with *Neobanisia* and possibly *Mathoris*, forms part of a morphologically specialized group of genera whose species, as far as known, feed during the larval stage on species of Sapotaceae.

B. myrsusalis is unusual in its almost pantropical distribution, with very little variation over the whole range. In the Malay Archipelago and New Guinea region several closely allied, but distinct, species occur. Some of the problems of distribution were discussed previously (Whalley, 1967 : 47) where the whole American-African-Indian group of specimens were regarded as one species. Further examination indicates that there is some justification for separating off the African-Indian specimens from the American ones. However, at present I can find no morphological differences between the African and Indian specimens and accordingly regard them as one subspecies. The Seychelles Islands have produced two distinct species, closely allied to *B. myrsusalis* on two small islands only fifty miles apart, whereas over the whole of the continent of Africa and in Madagascar no subspeciation of *myrsusalis* has occurred.

A possible reason for the pantropical distribution of *B. myrsusalis* may be found in the distribution of the larval food-plant. From the few records of bred specimens, the larvae of *B. myrsusalis* feed on species of Sapotaceae, particularly *Manilkara zapota* L. (Sapodillo, Nispero or Naseberry). *M. zapota* is the tree from which chewing-gum is obtained and which has for many years been transported by man around the tropics from its native America. Various other species of Sapotaceae also occur in the tropics and these may act as host-species, although at present there are no host-records other than *M. zapota*.

The introduction of *B. myrsusalis* during the transporting of its host-plant is dependent on the correlation of a number of factors. For example, the stage at which the planting material is taken (seed, cutting, etc.), and whether there is a possibility of the eggs, larvae or pupa (perhaps even the adult) surviving transport and finding suitable hosts while the introduced plant is getting established. There are many factors which argue against man-made introductions, but against these factors two facts must be set. Firstly, man-made introductions of a number of species are known to have occurred and, secondly, the incontrovertible fact that the species, *B. myrsusalis*, is at present widely distributed with little differentiation

between the extremes of the range. It is interesting that species of the genus *Mathoris* which has an American-African-Indian distribution (although with more differentiation than in *Banisia*) also feed on species of Sapotaceae.

The genus *Banisia* occurs in the tropics of the Nearctic, Neotropic, Ethiopian and Madagascan, Oriental, Australasian and Pacific regions.

Generic description. Proboscis present. Labial palps 3-segmented. Eyes without interfacetal hairs. Antennae moderately ciliate. Fore wing with radial veins usually from cell (only rarely with R_2+R_3 as given in the generic diagnosis by Whalley, 1967 : 47). Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Hind tarsi each with pair of spines at distal end. Male with bifid uncus, gnathus modified. Female with large signum in bursa.

Biology. Although there are few host-records for species of *Banisia* in Africa, in India it has been bred from species of Sapotaceae, particularly *Manilkara* (=*Achras*) *zapota* L. and *Bassia latifolia* Roxb. (Bose, 1935) and on *M. zapota* in Java (Whalley, 1967). The larvae and pupae are illustrated by Bose (1935) and Karlshoven (1950).

Key to the African Species of *BANISIA*

1		Wing 11 mm or over	2
–		Wing under 11 mm	***aldabrana*** (p. 63)
2	(1)	Reddish patch in median fascia and on costa of fore wing. Male with spines at apex of gnathus	***myrsusalis*** (p. 59)
–		No reddish patch on fore wing. Male with or without spines at apex of gnathus	3
3	(2)	Male with spines at apex to gnathus	***tibiale*** (p. 61)
–		Male without spines at apex of gnathus	***apicale*** (p. 62)

Banisia myrsusalis (Walker)

Pyralis myrsusalis Walker, 1859 : 892.
Rhodoneura elaralis Walker; Hampson, 1897 : 618.

The subspecies *B. myrsusalis myrsusalis* Walker occurs in North and South America and is very similar to *B. myrsusalis elaralis* Walker from Africa and India. In my revision of the Thyrididae of Madagascar (Whalley, 1967) I treated the African, Madagascan and Oriental specimens as a distinct species from the American specimens. Since examining more material from the rest of the world I now consider that, at the most, the African-Oriental specimens must be regarded as a subspecies, differing only slightly from the American subspecies. In the Seychelles Islands two distinct species have arisen on two of the islands some 50 miles apart. These two (*B. tibiale* and *B. apicale*) have slightly different male genitalia from African-Indian specimens of *B. m. elaralis*.

From host-records available the subspecies of *B. myrsusalis* feed on *Manilkara zapota* L. (Sapotaceae), the plant from which chewing-gum is obtained. This plant has been transported by man to most tropical countries, and with it perhaps, *B. myrsusalis*. Structurally the African-Indian specimens are practically indistinguishable. There is a slight difference in the outline of the uncus and the number of spines on the apex of the arms of the gnathus (brachia).

Banisia myrsusalis elaralis (Walker) **stat. n.**

(Pl. 2, H; Pl. 29, fig. 153; Pl. 51, figs 297, 298)

Pyralis elaralis Walker, 1859 : 901.
Pyralis idalialis Walker, 1859 : 903.
Durdara lobata Moore, 1879 : 177.
Durdara pyraliata Moore, 1879 : 177.
Durdara zonula Swinhoe, 1885 : 469.
Siculodes elaralis Walker; Pagenstecher, 1892 : 120.
Rhodoneura myrsusalis Walker; Hampson, 1897 : 618.
Rhodoneura myrsusalis Walker; Dalle Torre, 1914 : 27.
Rhodoneura myrsusalis Walker; var. *idalialis* Walker; Gaede, 1917 : 368.
Rhodoneura myrsusalis Walker, form *idalialis* Walker; Gaede, 1929 : 491.
Banisia elaralis (Walker) Whalley, 1967 : 47.

♂. Wing, 11–12·5 mm. Vertex grey-brown, irrorate with white. Antennae minutely ciliate. Labial palps with third segment 1/3 length of second segment. Thorax grey-brown, irrorate with black. Hind tibia slightly flattened, with scale tufts. Outer spur of distal pair 1/2 length of inner spur, proximal spurs longer than inner distal spur. Fore wing, pattern as in Pl. 2, H, brown with prominent orange-red area at apex of cell. Groups of small round translucent areas, varying in number from 5–9. Transverse lines on wing blackish. Radial veins from cell. Veins 1*A* and 2*A* joining 1/3 from base of wing to form single vein to wing margin. Hind wing, colour and pattern as fore wing but without translucent areas and orange-brown patch. Underside, pale mauve with brown and black markings, circular brown area at apex of cell under fore wing. Hind wing more suffused with reddish brown on underside than fore wing. $Sc+R_1$ and Rs approach closely for part of length.

GENITALIA ♂ (Pl. 29, fig. 153). Uncus bifid, socii with large scale tufts. Arms of gnathus (brachia) with tufts of spines subapically. Basal process of valve toothed. Juxta with toothed lateral arms, outcurved but not angled. Aedeagus with toothed edge to small sclerotized cornutus.

♀. Wing, 11·5–12 mm. Similar pattern to male but usually more reddish brown suffusion on wing. Labial palps protrude well in front of head, third segment approximately equal in length to second.

GENITALIA ♀ (Pl. 51, figs 297, 298). Ostium and VIIIth segment heavily spined. Duct of bursa lightly spined, narrow, broader in central part of length of duct. Bursa with prominent sclerotized signum consisting of rows of sclerotized plates with small teeth. Small rounded secondary sac attached to bursa on opposite side to signum.

DISCUSSION. There is some variation in colour and pattern of this subspecies. West African specimens tend to be greyer than East African and Madagascan ones, but this trend is not always constant. In Africa, *B. m. elaralis* has been recorded from most parts south of Sahara. In female specimens from S. Africa the signum is slightly smaller than specimens from Madagascar or West Africa. Some of the South African specimens lack the translucent areas in the fore wing and are probably beginning to differentiate from other populations of *elaralis* in the rest of Africa.

DISTRIBUTION. Map 28. Sierra Leone; Ivory Coast; Ghana; Nigeria; Democratic Republic of the Congo; Uganda; Tanzania; Kenya; Mozambique; Malawi; Rhodesia; South Africa; Madagascar; North and South India; Ceylon; Thailand; Indonesia; Java.

MATERIAL EXAMINED.

Holotype ♂ (*myrsusalis*), WEST INDIES: St Domingo, BM slide no. 8428, in BMNH.

Holotype ♂ (*elaralis*), CEYLON: (specimen lacks abdomen), in BMNH. Holotype ♀ (*idalialis*), SARAWAK: in UMO.

Holotype ♂ (*zonula*), INDIA: Bombay (specimen lacks abdomen), in BMNH. Holotypes of *pyraliata* and *lobata*, in ZMB (topotypes from India examined).

SIERRA LEONE: 1 ♂, Bo (*Revell*), xii.1967; 1 ♂ (*Revell*), x.1968; IVORY COAST: 1 ♂, Bingerville (*Melou*), xi.1913; 1 ♀, Bingerville (*Melou*), x–xi.1913; 1 ♂, 3 ♀, Bingerville (Alibert), 11.1943, on Sapodillo (*Manilkara zapota* L.); GHANA: 2 ♂, 1 ♀, N. Territories, Kete-Krachi (*Cardinall*); 1 ♀, Navaro, 11° N, 1·30° W, vi.1923 (*Cardinall*); 1 ♀, Winnebah, i.1940, in CMP; 1 ♀, Sekondi (*Hamlyn*); 1 ♀, Juaso, i.1938 (*Cansdale*); NIGERIA: 1 ♀, Niger, Degama (*Ansorge*); DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♀, Kassai Distr. (*Taymans*); 1 ♂, Kasai, Sankuru, Pena Dibele, iv.1959 (*Carcasson*); 1 ♂, Ifuta, 31.x.1929 (*Verlaine*), in MRAC; UGANDA: 2 ♂, Masaka, Katera, Sango Bay, x.1960 (*Carcasson*), in NMK; 1 ♀, Zika Forest, Entebbe, vii.1961, in NMR; TANZANIA: 1 ♂, 6 ♀, Amani (*Robertson*); 1 ♂, Dar-es-Salaam; 1 ♀, Usambari, Nguelo (*Kimmer*); 1 ♀, Usambara, Amani, vii.1961 (*Pringle*), in NMK; KENYA: 1 ♂, Tiwi, Mombasa, iv–v.1957 (*Carcasson*), in NMK; 2 ♀, Mombasa (*van Someren*); 2 ♀, Coast, Gazi Forest, xii.1961 (*Carcasson*), in NMK; MOZAMBIQUE: 1 ♀, Lourenco Marques (*Daintree*), 15.iii.1938, in TMP; 3 ♂, 1 ♀, Dondo Forest, Dondo, xi.1967 (*Pinhey*), in NMR; 1 ♂, Chiluva Hills, x.1963, in NMR; MALAWI; 1 ♂, Mt Mlanje, iii.1913 (*Neave*); 1 ♂, 1 ♀, Nkata Bay, xii.1961, in NMR; RHODESIA: 1 ♂, Umtali, 5.i.1918 (*Janse*), in TMP; SOUTH AFRICA: 2 ♀, Kowie River, C.P. (*Irving*), x.1919, in TMP; 2 ♂, 2 ♀, Nderema (*van Son*), in TMP; 2 ♀, Sunwich Port, 30.x.1951 (*Janse*), in TMP; 1 ♀, Cape Province, Knysna, Wilderness (*Kettlewell*), iv.1950; 1 ♀, East London, xii.1921 (*Munroe*); 1 ♀, Blaney, xii.1940 (*Clark*), in TMP; 1 ♀, Port St Johns, ii.1955 (*Janse*), in TMP; 1 ♀, Natal (*Spiller*); 2 ♂, 2 ♀, Mfongosi, Zululand, i–iii.1912 (*Jones*), in CT.

Banisia tibiale (Fryer) **comb. n.**

(Pl. 6, fig. 23, Pl. 29, fig. 154)

Rhodoneura tibiale Fryer, 1912 : 20.
Rhodoneura tibiale Fryer; Legrand, 1965 : 88.

♂. Wing, 13·5 mm. Vertex brown. Antennae missing. Labial palps damaged, third segment missing. Frons projecting slightly between eyes. Thorax brown. Hind tibia with scale tufts, distal pair of spurs with outer spur slightly shorter than inner spur. Fore wing, pattern as in Pl. 6, fig. 23, grey-brown with darker transverse markings. Small translucent spot in fore wing. Radial veins from cell. Underside paler, subapical dark patch. Hind wing, pattern as fore wing but without translucent spot. $Sc+R_1$ and Rs approach but do not join.

GENITALIA ♂ (Pl. 29, fig. 154). Uncus bifid. Gnathus with patch of spines on each side near apex. Median basal process sclerotized, toothed on posterior margin. Lateral juxta lobes slender, slightly toothed posterior margin. Aedeagus with sclerotized cornutus.

♀. Unknown.

DISCUSSION. This species is similar externally to *B. apicale* but the spots on the wing are less conspicuous in *tibiale* and the apex of the wing is less pointed. In the male genitalia the lateral juxta arms are more slender and longer than in *apicale*.

From *B. m. elaralis*, *B. tibiale* can be separated by the pattern, the shape of the median basal process of the valve, the juxta lobes and the shape of the patch of spines on each side of the gnathus. *B. tibiale* is more distinct from *B. m. elaralis* than *elaralis* is from the South American subspecies *B. m. myrsusalis*. It seems that the small islands in the Seychelles have produced two distinct endemic species (*tibiale*, *apicale*) closely allied to *B. myrsusalis*, which is otherwise a remarkably constant species over several continents. *B. tibiale* occurs on two islands in the Seychelles group, including the same island as *B. apicale*. This fact is the one reason for considering them as distinct species rather than as subspecies of *B. myrsusalis*.

Distribution. Map 28. Seychelles.

Material examined.

LECTOTYPE here designated, labelled Seychelles: Marie Anne (*Percy Sladen Trust Expd.*), BM slide no. 8431, in BMNH.

Paralectotype. Seychelles: 1 ♂, Silhouette, 1908, in DZUC.

Banisia apicale (Fryer) **comb. n.**

(Pl. 6, fig. 21; Pl. 29, fig. 156; Text-fig. 5)

Rhodoneura apicale Fryer, 1912 : 21.
Rhodoneura apicale Fryer; Gaede, 1929 : 492.
Rhodoneura apicale Fryer; Legrand, 1965 : 88.

♂. Wing, 13 mm. Vertex brown. Antennae shortly ciliate. Labial palps long, nearly 2× diameter of eye, third segment 1/3 length of second. Frons rounded, protruding slightly between eyes. Thorax brown. Hind tibia with scale-tuft, two pairs of spurs (Text-fig. 5). Fore wing, pattern as in Pl. 6, fig. 21, grey with black spots and small round translucent spot immediately posterior to cell in fore wing. Radial veins from cell. Underside, as upperside, paler. Hind wing, colour as fore wing, pattern similar but without translucent area.

Genitalia ♂ (Pl. 29, fig. 156). Uncus bifid. Gnathus weakly sclerotized, no spiny patch near apex. Socii well developed. Juxta with short spiny lateral lobes. Median basal process of valve downcurved with few teeth. Aedeagus with sclerotized plate forming cornutus.

♀. Unknown.

Discussion. Although I have examined only one specimen, I feel that the differences between this and *tibiale* and the fact that they apparently occur in the same locality are sufficient to indicate specific status for them. *B. apicale* can be separated from *B. m. elaralis* by the greyer colour and by the lack of spines at the apex of the gnathus. This species is even more distinct from *B. m. elaralis* than *elaralis* is from *tibiale*. Both *tibiale* and *apicale* are probably derived from isolated populations of *B. myrsusalis* and this differentiation has taken place on the Seychelles Islands in spite of the remarkable constancy of *B. myrsusalis* over the rest of its range.

Distribution. Map 28. Seychelles.

Material examined.

Holotype ♂, Seychelles: Silhouette (Percy Sladen Trust Expedition), BM slide no. 9844, in BMNH.

Banisia aldabrana (Fryer) **comb. n.**

Rhodoneura aldabrana Fryer, 1912 : 21.

The subspecies described below are separated on the basis of size and colour, otherwise they are morphologically similar. *B. aldabrana* was regarded as endemic to Aldabra (Legrand, 1965) but specimens from the mainland differ very little from those from Aldabra, and there is also some overlap in the size of the two subspecies.

KEY TO THE SUBSPECIES OF *BANISIA ALDABRANA* Fryer

1	Wing 7·5–11 mm. Pale grey to dark grey	***a. cana*** (p. 64)
–	Wing under 7·5 mm. Reddish brown	***a. aldabrana*** (p. 63)

Banisia aldabrana aldabrana (Fryer) **stat. n.**

(Pl. 1, E; Pl. 29, fig. 155; Pl. 52, figs 299, 300)

Rhodoneura aldabrana Fryer, 1912 : 21.
Betousa aldabrana (Fryer) Gaede, 1929 : 496.
Rhodoneura aldabrana Fryer; Legrand, 1965 : 88.

♂. Wing, 7–7·5 mm. Vertex brown. Antennae minutely pectinate. Labial palps short, approximately equal to diameter of eye, third segment 1/3 length of second. Frons slightly produced between eyes. Thorax brown. Hind tibia with outer spur of distal pair 1/2 length of inner spur. Fore wing, pattern as in Pl. 1, E, reddish brown with darker brown transverse lines. Underside with darker subapical patch, otherwise similar to upper. Radial veins from cell. Hind wing, pattern as fore wing, $Sc+R_1$ and Rs approach but do not touch.

GENITALIA ♂ (Pl. 29, fig. 155). Uncus bifid. Socii prominent with long scales. Gnathus weakly sclerotized. Median basal process on valve curved, prominent inward projecting peg from this process. Aedeagus with minute spines in vesica.

♀. Wing, 10–10·5 mm. Pattern as in male but much more reddish in colour. Labial palps $1\frac{1}{2}\times$ diameter of eye.

GENITALIA ♀ (Pl. 52, figs 299, 300). Anal papillae short. Ostium slightly sclerotized. Duct long. Bursa with large signum consisting of small sclerotized plates, each with a small spine. Secondary sac present on bursa.

DISCUSSION. This species has very similar genitalia to *B. myrsusalis elaralis*, differing mainly in the shape of the median basal process of the valve and the lack of the long spines at the apex of the gnathus arms. Although no differences could be found in the genitalia of the male specimens from Africa from those of Aldabra, there is generally a difference in size and colour. The Aldabran specimens tend to be smaller and more reddish brown, while the African specimens are distinctly grey. This is particularly true of the female specimens from Aldabra, which are a very reddish brown, but unfortunately no females from Africa were available for comparison. The separation of these two subspecies is therefore on very slight differences.

DISTRIBUTION. Map 29. Aldabra (Seychelles Islands).

MATERIAL EXAMINED.

LECTOTYPE ♂, here designated, SEYCHELLES: Aldabra (*Fryer*) (Percy Sladen Trust Expedition), BM slide no. 9821, in BMNH.

Paralectotypes. 1 ♂, 1 ♀, data as type.

ALDABRA: 1 ♂, 2 ♀, [19]08–09 (*Fryer*), in DZUC; 2 ♂, 2 ♀, xi–xii.1959 (*Gerber*), in MNHN; 1 ♂, 1 ♀, xi.1959 (*Legrand*), in MNHN; 1 ♀, Cosmoledo, 18.x.1959 (*Legrand*), in MNHN; 2 ♀, West Island, near Settlement, 7–12.iii.1968 (*Cogan & Hutson*); 2 ♂, South Island, Takamaka Pool, 1–17.ii.1968 (*Cogan & Hutson*).

Banisia aldabrana cana **subsp. n.**

(Pl. 1, D; Pl. 29, fig. 157)

♂. Wing, 7·5–11 mm. This subspecies differs from the nominate one in colour and is usually larger. The wings vary in colour from pale grey with dark reticulations to dark grey with dark reticulations (Pl. 1, D). There are often one or two translucent areas in the fore wing. Externally there are some differences in colouration in the specimens from Kenya, some of which are paler than the specimens from South Africa. With the few specimens available, and a certain amount of overlap in colouration, the exact limits of this subspecies is not clear.

GENITALIA ♂ (Pl. 29, fig. 157).

♀. Unknown.

DISTRIBUTION. Map 29. Kenya; South Africa.

MATERIAL EXAMINED.

Holotype ♂, SOUTH AFRICA: Cape Province, Mossel Bay, viii.1932 (*Turner*), BM slide no. 10553, in BMNH.

Paratypes. SOUTH AFRICA: 1 ♂, Port St Johns (*Janse*), 10–22.ii.1955, in TMP; 1 ♂, Port St Johns, Pondoland, 1–17.iii.1924 (*Turner*); 1 ♂, Verulam, 30.xii.1915 (*Janse*), in TMP; 2 ♂, Kowie River, CP (*Irving*), x.1918, in TMP; 1 ♂, Kasonga, i–ii.1940 (*Omer Cooper*).

Material not included in type-series. KENYA: 1 ♂, Malindi, v.1934 (*Jackson*); 1 ♂, Mombasa Tiwi, iv.1964 (*Carcasson*); 1 ♂, Mombasa, Diani, x–xi.1951 (*Pinhey*).

STRIGLINA Guenée

Striglina Guenée, 1877 : 283. Type-species, *Striglina lineola* Guenée, by subsequent designation, Whalley, 1964a : 126.

Plagiosella Hampson, 1897 : 625. Type-species, *Plagiosella clathrata* Hampson, by original designation. (Synonymized by Whalley, 1967 : 42).

Plagiosellula Strand, 1913 : 62. Type-species, *Plagiosellula strigifera* Strand, by monotypy. (Synonymized by Gaede, 1917 : 372).

Heteroschista Warren, 1903 : 271. Type-species, *Heteroschista nigranalis* Warren, by original designation, **syn. n.**

Heteroschista Warren; Gaede, 1917 : 374 (as a junior synonym of *Mathoris* Guenée).

This genus, which is morphologically very distinct from all other Thyridid genera, is widespread over the Indo-Australian region as well as being common in the Ethiopian region. The morphological characters of the male genitalia show pronounced interspecific differences while intraspecific variation is small. In spite of the interspecific differences there are certain common features not found in other genera. The differences between the species in *Striglina* are often as striking as some of the differences between genera in other Thyridid subfamilies, but these

differences in *Striglina* are often only single character ones. While these differences are striking considered in relation to species of other genera in Africa, I prefer not to separate new genera from *Striglina* until species in the other faunae have been studied. Throughout the genus the genitalia of the males are highly modified. The type-species of the genus (*S. lineola* Guenée) from India has similar genitalia to the *clathrata*-group from Africa but lacks the fusion of some of the radial veins in the fore wing.

In the African fauna, for convenience, I make two major divisions of the genus based on the shape of the gnathus in the male.

GROUP 1 are the species where the males have a row of peg-like teeth on the gnathus.

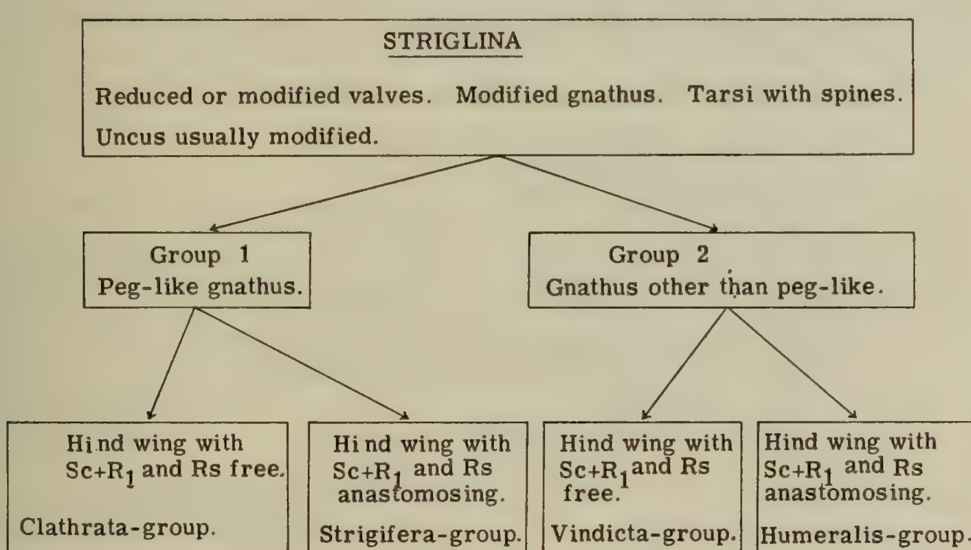
GROUP 2 are the species where the gnathus is veriously modified but never has peg-like teeth.

These divisions may be subgeneric but there are various characters which are found in both groups and a clear division on several characters is not possible at present. Both groups have species with interfacetal hairs on the eyes, with *Rs* anastomosing with $Sc+R_1$ in the hind wings and with rows of spines on the hind tarsi. The Indo-Australian species so far examined fit into these groups but a more complete picture of this complicated genus will emerge when other faunae are studied.

The next divisions into which Group 1 and Group 2 are both divided are the species-groups, which are based on the anastomosing of $Sc+R_1$ and *Rs* in the hind wing.

TABLE 3

Divisions of genus Striglina



The tarsi in both Groups 1 and 2 usually have rows of spines on each segment but in some species in each group there are those where the spines are reduced to the apical pair. The valves are usually reduced and may be represented by only a narrow strap-like piece. In the *strigifera*-group the valve is highly modified and toothed In *S. tincta* the valve is relatively simple but there is a large scale tuft on it and in *S. nigranalis* there is a strong lateral process on the valves. Only one species (*S. tincta*) has a relatively simple uncus, all the other species have various modifications. All the females of the genus have a similar shaped bursa with a signum usually present (except *nigranalis* and *rothi*) and usually have a strongly sclerotized ostium.

Certain aspects of the morphology of the genus indicate that it may be related to *Banisia* Walker but a close analysis will have to await generic revisions (in progress).

Species of *Striglina* are widespread in West and Central Africa but few have been found in East Africa and none in South Africa, although they occur in Rhodesia. One species of the genus occurs in Madagascar (Whalley, 1967). Most of the African species come from regions of higher rainfall and the little data available suggests that they are forest-living species.

The genus is widespread in the Indo-Pacific Region with many species but has a few species in the New World.

Generic description. Eyes with or without interfacetal hairs. Proboscis present. Labial palps 3-segmented. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Tarsi with spines, either an apical pair or rows of spines on each segment. Hind wing with $Sc+R_1$ and Rs free or joined for part of length. Uncus usually modified. Valves reduced or modified. Signum usually present. Ostium often highly sclerotized.

Biology. *S. clathrata* has been bred from Coffee bushes in Kenya (no indication if *arabica* or *robusta* but probably the latter), where it was rolling the leaves. *S. rothi* has been bred from the leaves (?) of *Terminalia ivoriensis*. No data are available for any other African species. In India *S. lineola* Guenée has been bred from a variety of plants (*Albizza*, *Bauhinia*, *Cassia*, *Milletia*, *Xylia*, see Beeson, 1941).

Key to the African Species of *STRIGLINA*

1		Hind wing with $Sc+R_1$ and Rs joined for part of length	2
–		Hind wing with $Sc+R_1$ and Rs free	8
2	(1)	Tarsi with rows of spines along length	3
–		Tarsi with apical pair of spines only (Humeralis species-group, only separable on male genitalia)	6
3	(2)	Fore wing with R_2+R_3	**nigranalis** (p. 83)
–		Fore wing with R_4+R_5 (Strigifera species-group, only separable on male genitalia)	4
4	(3)	Uncus with 4 long processes **trepida** (p. 75) or uncus with 3 processes **augescere** (p. 75)	
–		Uncus with 2 long processes only, or 2 long and 2 short	5
5	(4)	Uncus with two long processes	**strigifera** (p. 73)
–		Uncus with 2 long and 2 short processes	**ferula** (p. 74)
6	(2)	Uncus bifid	**humeralis** (p. 81)
–		Uncus simple	7
7	(6)	Uncus clavate	**jacanda** (p. 82)
–		Uncus not clavate	**tincta** (p. 82)
8	(1)	Eyes with interfacetal hairs	9

–		Eyes without interfacetal hairs	10
9	(8)	Uncus bifid, two narrow processes. Female with signum as Pl. 54, fig. 316	***guttistigma*** (p. 80)
–		Uncus with broad lateral process (Pl. 29, fig. 158). Female with signum as in Pl. 52, fig. 305	***eguttalis*** (p. 67)
10	(8)	Radial veins R_2 to R_5 in fore wing separately from cell. (Vindicta species-group, only separable on male genitalia)	11
–		Some of veins R_3 to R_5 fused for at least part of length	12
11	(10)	Bifid uncus (Pl. 32, fig. 176)	***ramosa*** (p. 79)
–		Single uncus	***vindicta*** (p. 77)
12	(10)	Fore wing with R_4+R_5. Valve of male genitalia reduced. Female with signum (Pl. 53, fig. 306)	***clathrata*** (p. 70)
–		Fore wing with R_4+R_5 and R_3+R_3. Female without signum .	***rothi*** (p. 68)

Group 1

Species in this group have a peg-like gnathus in the male genitalia. The divisions in *Striglina* could be made in several ways based on wing venation or the presence or absence of interfacetal hairs. Neither of these ways seem to produce any obvious advantage over the division adopted. Whilst the close proximity of *eguttalis* and *guttistigma* is obtained, for example, if the division is based on the presence of interfacetal hairs in the eyes and the separateness of $Sc+R_1$ and Rs in the hind wing, numerous aspects in the genitalia (cf. Pl. 29, fig. 158 and Pl. 31, fig. 171, ♂; and Pl. 52, fig. 303 and Pl. 54, fig. 315, ♀) are very different. Although the weighting of characters is not entirely desirable, it is difficult to reconcile the evidence from the genitalia (based on a number of characters, although for convenience used only as the form of the gnathus) compared with the fusion for part of their length of wing veins (which are known to vary within species and occasionally within specimens) and the presence of interfacetal hairs. The fusion of veins in the hind wing occurs in a number of genera but interfacetal hairs have been found only in species of *Striglina*, as has the peg-like gnathus. In the absence of fossil or other evidence, the results obtained using comparative morphology to determine relationship are controversial. The classification produced in this genus should be regarded firstly as a convenient division enabling identification and only secondly, as an attempt to show possible relationships.

The *CLATHRATA*-Group

This species-group includes *clathrata*, *rothi* and *eguttalis*. These species have $Sc+R_1$ and Rs free in the hind wing. *S. eguttalis* has R_2 to R_5 from the cell in the fore wing, interfacetal hairs and tarsi with one pair of apical spines on each segment. This contrasts with the other species where R_4 and R_5 have a common stalk, the tarsi have rows of spines and the eyes are without hairs. The species, *S. minutula* Saalmüller, from Madagascar is also in this species-group.

Striglina eguttalis Gaede

(Pl. 6, fig. 24; Pl. 29, figs 158, 159; Pl. 52, figs 303–305; Text-fig. 9)

Striglina eguttalis Gaede, 1917 : 378.
Striglina eguttalis Gaede; Gaede, 1929 : 495.

♂. Wing, 14·5–16 mm. Vertex black with a few white scales. Frons black, flattened between eyes. Antennae minutely ciliate. Labial palps with third segment 1/3 length of second. Eyes with long interfacetal hairs. Thorax and patagia blackish brown. Hind tibia with long scales, distal pair of spurs short, less than 1/2 length of 1st hind tarsal segment. Inner spur of distal pair almost equal to length of outer spur. Hind tarsi each with pair of spines at distal end. Fore wing, pattern as in Pl. 6, fig. 24, black with reddish costal, median and postmedian areas. Radial veins from cell. Hind wing, colour and pattern as fore wing, underside browner than fore wing. $Sc+R_1$ and Rs free, but approaching closely near base of wing.

GENITALIA ♂ (Pl. 29, figs 158, 159, Text-fig. 9). Uncus modified, gnathus with peg-like teeth. Valves reduced. Juxta a thin plate, lateral process short. Aedeagus with many strongly sclerotized cornuti. VIIIth sternite with two posterior arms.

♀. Wing, 17 mm. Pattern as male, slightly more red on fore wing. Labial palps with third segment 1/2 length of second.

GENITALIA ♀ (Pl. 52, figs 303–305). Anal papillae short. Ostium enlarged to form large sac. Bursa with prominent signum forming transverse spiny plate.

DISCUSSION. The peculiar shape of the genitalia of this species suggests some affinity with *S. clathrata* Hampson. The shape of the uncus is different from all other species of the genus. The long interfacetal hairs on the eyes and the single pair of spines on each tarsal segment are also found in *S. guttistigma* but this species differs from *eguttalis* in not having a peg-like gnathus. These two species also have a similar type of tarsal claw structure with two lateral sclerites.

DISTRIBUTION. Map 33. Cameroon; Gabon; Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♂, GABON: BM slide no. 9627, in ZMB.

CAMEROON: 1 ♂, Efulen (*Weber*), vi.1922, in CMP; 1 ♀, Ja River, Bitje (*Bates*), iv–vi.1910; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Paulis, Uele, i.1957 (*Fontaine*), in MRAC; "WEST AFRICA": 1 ♀, no other data.

Striglina rothi Warren

(Pl. 1, P, Q; Pl. 30, fig. 160; Pl. 52, figs 301, 302)

Striglina rothi Warren, 1898b : 226.
Plagiosellula clathratipennis Strand, 1913 : 61, **syn. n.**
Striglina rothi Warren; Dalle Torre, 1914 : 12.
Dixoa clathratipennis (Strand); Gaede, 1917 : 371.
Striglina rothi Warren; Gaede, 1917 : 370.
Striglina rothi Warren; Gaede, 1929 : 495.
Dixoa clathratipennis (Strand); Gaede, 1929 : 496.

♂. Wing, 9·5–10·5 mm. Vertex brown. Frons brown, rounded between eyes. Antennae minutely ciliate. Labial palps with third segment short, less than 1/3 length of second upturned, not reaching vertex. Eyes without interfacetal hairs. Thorax brown. Hind tibia with outer spur of distal pair less than 1/2 length of inner spur. Tarsi each with apical pair of spines. Fore wing, pattern as in Pl. 1, P, Q, reddish or yellowish brown, with darker brown margins and median area. Reticulations generally reddish. Veins R_4 and R_5 stalked; R_2 and R_3 stalked. R_2 coming off 1/3 from apex of cell. The stalks of R_2+R_3 and R_4+R_5 widely separated. $2A$ absent. $1A$ dips slightly to wing margin near base. Underside, two median dark patches prominent, margins pale. Hind wing, colour as fore wing, two or three light coloured patches in anal area. $Sc+R_1$ and Rs approach closely but do not anastomose.

GENITALIA ♂ (Pl. 30, fig. 160). Uncus bifid with two finger-like lateral processes (socii ?), apex of gnathus with prominent median triangular-shaped process with peg-like teeth. Valve with prominent apical spur, basal region of valve enlarged by membranous fold covered with hairs. Juxta, two flattened lateral arms, lightly sclerotized and covered with hair. Aedeagus with spiny vesica. Prominent pair of coremata. Posterior margin of VIIIth sternite concave.

♀. Wing, 13·5–14 mm. Darker brown coloured than male. Labial palps with third segment 1/2 length of second. Pattern as male.

GENITALIA ♀ (Pl. 52, figs 301, 302). Anal papillae short, duct of bursa convolute. Broad V-shaped ostium each side of the "V" covered with hairs. No signum.

DISCUSSION. There is sexual dimorphism in the labial palps and size in this species. Specimens vary in intensity of the wing colour and to some extent in pattern. Some variation in the length of the apical process on the valve of the male occurs but at present this has not been correlated with any other feature which might suggest subspeciation. Nevertheless the variation in specimens from a wide range of localities suggests that, when a longer series are examined, more evidence of subspeciation will be found. Externally this species resembles *S. minutula* Saalmüller from Madagascar but the genitalia are distinct.

DISTRIBUTION. Map 30. Sierra Leone; Liberia; Ivory Coast; Ghana; Nigeria; Cameroon; Rio Muni; Gabon; Democratic Republic of the Congo; Uganda; Angola.

MATERIAL EXAMINED.

LECTOTYPE ♀, (*rothi*) here designated, NIGERIA: Warri, v.[18]97 (*Roth*), BM slide no. 9107, in BMNH. Holotype ♂ (*clathratipennis*), RIO MUNI: Benitogebiet, 15–30.vi.1906 (*Tessmann*), BM slide no. 9509, in ZMB.

SIERRA LEONE: 1 ♂, 4 ♀, Moyambe, vi.1902, iv–v.1903 (*Cator*); 1 ♂, Njala, ix.1930 (*Hargreaves*); 1 ♂, 1 ♀ (*Clements*), iii–iv.1895 (one specimen in USNM); 1 ♂, Hill Station, xii.1933 (*Frére*); 1 ♀, Sierra Leone (no other data); 3 ♂, 1 ♀, Bo (*Revell*), iii–iv.1967; 1 ♂, 2 ♀, Bo (*Revell*), i–iii.1969; 1 ♂, Bo (*Revell*), x.1968; 2 ♂, 1 ♀, Bo (*Revell*), xi–xii.1967; LIBERIA: 2 ♂, 1 ♀, Nimba, Grassfield, ii–iii.1968 (*Forbes-Watson*), in NMK; 1 ♀, Nimba, Grassfield, vii–viii.1967 (*Forbes-Watson*); IVORY COAST: 1 ♂, Agboville, vi.1915 (*Melou*); 1 ♀ (*Cremer*), 1919; GHANA: 2 ♂, Coomassie [Kumasi] (*Whiteside*); 1 ♂, Aprade, viii.1968, ex *Terminalia ivoriensis*; 3 ♀, Kumasi (*Sanders*); NIGERIA: 1 ♂, Vivet, v.1906 (*Dudgeon*); 1 ♀, Niger, Oguta (*Ansorge*), xi.1907; 1 ♂, Niger, Agberi (*Ansorge*), vii.1907; 1 ♂, Nigeria (no other data); 1 ♀, Warri, v.1897 (*Roth*) (paralectotype); 1 ♀, Old Calabar (*Crompton*); CAMEROON: 27 ♂, Efulen (*Weber*) (various years), in CMP; 4 ♂, 2 ♀, Lolodorf (*Good*), in CMP; 1 ♂, Lolodorf (*Conradt*), 1894–95; 3 ♂ (*Schwab*), xi.; 3 ♂, 1 ♀, Johann Albrechts Höhe (*Conradt*), 1896; 1 ♂, Batouri Distr. (*Merfield*), vi.–vii.1935; 1 ♂, 1 ♀, Bitje, Ja River, 2000 ft (*Bates*), vii. 1909; 1 ♂, Yabassi Distr. [French Cameroon], xii.1937 (*Merfield*); 1 ♂, Lomie, C.I., ix.1962 (Oxford Univ. Exp.), in NMR; RIO MUNI: 1 ♂ (type, *clathratipennis*), in ZMB; GABON: 1 ♂, Belinga, 600 m, Camp Centrale, iii.1962 (*Bernardi*); in MNHN; 1 ♂, Ile de Lambirini, xii.1916–i.1917; 2 ♂, Fernan Vaz, Lake Asebbe (*Ansorge*), ii.1908; 8 ♂, 2 ♀, Kangwe, Ogove River (*Good*), in CMP; 3 ♂, 1 ♀, Kangwe, in CMP; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, 1 ♀, Sankuru, Katako-Kombe, xi.1952, i.1953 (*Fontaine*), in MRAC; 1 ♂, Itoko à Gombe, 1921 (*Verlaine*), in MRAC; 1 ♂, Bumba (*Waelbroeck*), x.1905, in MRAC; 1 ♂, Kindu (*Burgeon*), xi.1913, in MRAC;

1 ♀, Yambata, ii–iii.1914 (*Giorgi*), in MRAC; 1 ♂, Ebolowa, xi.1941., in CMP; 1 ♀, Equateur, Bokuma, ii.1936 (*Hulstaert*), in MRAC; 1 ♂, Equateur, Loile River, Ikela, iv.1959 (*Carcasson*), in NMK; 1 ♂, Bupoto, Upper Congo (*Kenred-Smith*); 1 ♂, Congo (no other data); UGANDA: 1 ♀, Kalinzu Forest, W. Ankole, iv.1938 (*Jackson*); 1 ♂, Jinja, Mabira (*Carcasson*), x.1962; 2 ♂, Katera, Sango Bay, Masaka, x.1960 (*Carcasson*); 3 ♂, Kalinzu Forest, Ankole, xi.1961 (*Carcasson*), in NMK; 1 ♀, Kigezi, Kayonza (*Jackson*), vi.1957; 1 ♂, Zika Forest, Entebbe, v.1961, in NMR; ANGOLA: 1 ♂, Quicolungo, 120 km N. of Lucala, 800 m, v.1936 (*Braun*); WEST AFRICA: 1 ♂ (no other data).

Striglina minutula (Saalmüller)

Betousa minutula Saalmüller, 1880 : 295.
Striglina minutula (Saalmüller) Whalley, 1967 : 43, figs 14, 16, 43, 71.

DISTRIBUTION. Madagascar. Map 30.

Striglina clathrata (Hampson)

Plagiosella clathrata Hampson, 1897 : 626.
Plagiosella clathrata Hampson; Dalle Torre, 1914 : 39.
Plagiosella clathrata Hampson; Gaede, 1917 : 372.
Plagiosella clathrata Hampson; Gaede, 1929 : 496.
Plagiosella clathrata Hampson; Whalley, 1964a : 124
Striglina clathrata (Hampson) Whalley, 1967 : 42.

S. clathrata has been regarded as a widespread African species (Gaede, 1929 : 496), but it consists of at least three subspecies, one sufficiently different on genitalia characters that it could perhaps be considered a distinct species. However, the external morphology is similar in all three subspecies and two of them are known only from single localities at the edge of the range of the nominate one.

The nominate subspecies is widespread throughout West and Central Africa. It appears to be restricted to the tropical rain-forest, whereas of the two subspecies, the Kenyan one is from a drier zone. This is the most distinct of the subspecies both in size and genitalia. The other species from Tanzania (Amani), differs in size and colouration from the nominate one. This species is closely allied to *Striglina minutula* (Saalmüller) from Madagascar, differing only in small details in the genitalia. It might be better to consider the Madagascan species as a subspecies of *clathrata* but more information on the biology is needed.

KEY TO THE SUBSPECIES OF *STRIGLINA CLATHRATA* Hampson

1	Juxta short (Pl. 30, fig. 164)	***c. declivita*** (p. 72)
–	Juxta long (Pl. 30, figs 163, 165)	2
2	Larger species, wing 12–14 mm. Ground colour reddish brown	***c. amani*** (p. 71)
	Smaller species, wing 9–13 mm. Ground colour grey-brown	***c. clathrata*** (p. 70)

Striglina clathrata clathrata (Hampson) **stat. n.**

(Pl. 1, M; Pl. 30, figs 162, 165; Pl. 53, figs 306–308)

Plagiosella clathrata Hampson, 1897 : 626.

♂. Wing, 9–10·5 mm. Vertex and frons brown. Antennae minutely ciliate. Labial palps slightly longer than diameter of eye, third segment of palp 1/4 length of second segment. Eyes without interfacetal hairs. Thorax brown. Hind tibia with proximal pair of spurs long, distal pair short. Tarsi with rows of spines along each segment. Fore wing, pattern as in Pl. 1, M, grey-brown with white maculations. Veins R_4 and R_5 with common stalk. Underside, paler. Hind wing, as fore wing, $Sc+R_1$ and Rs approach closely but do not join.

GENITALIA ♂ (Pl. 30, figs 162, 165). Uncus bifid. Gnathus a row of pegs adjoining spiny and lightly sclerotized subscaphium. Valve very reduced. Sacculus enlarged. Base of valve with prominent peg-like process. Juxta, two lateral lobes, broader near middle. Aedeagus with at least 10 long cornuti. VIIIth abdominal sternite deeply incised.

♀. Wing, 11–12·5 mm. Colour and pattern as male. Labial palps long, 2–2½ × diameter of eye, third segment of palp 1/2 length of second.

GENITALIA ♀ (Pl. 53, figs 306–308). Anal papillae short, strongly sclerotized ostium. First part of duct sclerotized, rest lightly sclerotized and coiled. Signum a narrow, minutely toothed, band across bursa.

DISCUSSION. West African and Western Ugandan specimens are smaller and darker than those from the Cameroon, otherwise there is little variation in the extent of the dark area on the wings. This subspecies can be separated from *S. clathrata amani* by its smaller size (9–13 mm, *c. clathrata*; 12–14 mm, *c. amani*) and by the ground colour, which is grey-brown in *c. clathrata* but reddish brown in *c. amani*. From *c. declivita* it can be distinguished by its smaller size and by differences in the shape of the process at the base of the valve, the juxta and by the uncus.

DISTRIBUTION. Map 31. Sierra Leone; Ivory Coast; Ghana; Fernando Po; Gabon; Cameroon; Democratic Republic of the Congo; Uganda; Angola.

MATERIAL EXAMINED.

Holotype ♂, GHANA: Aburi, BM slide no. 9028, in BMNH (holotype specimen badly damaged); SIERRA LEONE: 2 ♂, Njala (*Hargreaves*), iv–viii.1932; 2 ♂, Moyamba (*Cator*); IVORY COAST: 1 ♀, Bingerville (*Melou*), viii.1915; GHANA: 1 ♂, Ashanti, Geaso (*Gibbs*); FERNANDO PO: 1 ♂ (*Nicholls*), 1 ♂ (*Cooper*); GABON; 1 ♂, Kangwe, in CMP; CAMEROON: 7 ♂, 1 ♀, Johann Albrechts Höhe (*Conradt*), 1896–98; 1 ♀, Batouri Distr. Gadji (*Merfield*), 1935; 4 ♂, Efulen, 1912–17 (*Weber*), in CMP; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Beni (*Jackson*), v.1947; 1 ♀, Kasai, Lodja, iii.1959 (*Carcasson*); 1 ♂, nr Lac Kivu, Rwankwi (*Leroy*), xi.1947, in MRAC; 1 ♂, Uele, Masua, 16.vi.1934 (*Bredo*), ex coffee plant, in MRAC; 1 ♂, Uele, Bambesa, 1958–9 (*Warlet*), in MRAC; 1 ♂, 1 ♀, Upper Uele Distr., Dungu, iv; UGANDA: 1 ♂, Bwamba, Toro (*Mitton*), xi.1961, in NMK; 2 ♂, Bwamba (*Carcasson*), v.1958, in NMK; 1 ♂, Masaka, Katera, Sango Bay, x.1960 (*Carcasson*); 1 ♂, Kigezi, Kayonza (*Jackson*), 1957; 2 ♂, Jinja, Mabira Forest, x.1962 (*Carcasson*), one in NMK; 1 ♂, Lake Albert; ANGOLA: 1 ♂, N'Dalla Tando, 2700 ft (*Ansorge*), xi.1908.

Striglina clathrata amani ssp. n.

(Pl. 1, N; Pl. 30, fig. 163)

♂. Wing, 12–14·5 mm. Morphologically similar to nominate subspecies but larger and with more reddish brown wing colour. Separated from *c. declivita* by the reddish colour of the wing (Pl. 1, N) and shape of parts of the male genitalia.

GENITALIA ♂ (Pl. 30, fig. 163).

♀. Wing, 14 mm. Colour and pattern as male. Larger and more reddish brown than nominate subspecies. The female can be separated from *c. declivita* by the shape of the ostium, the sclerotized edges are serrate or wavy in *c. amani* and *c. clathrata* but smooth in *c. declivita*.

GENITALIA ♀. As nominate subspecies.

DISCUSSION. This subspecies is the most easterly of the group. It is interesting that it has differentiated only in size and colour from the nominate one and not differentiated in genitalia as has the Kenyan species. *C. amani* occurs in a wet region similar to the nominate subspecies whereas the Kenyan subspecies occurs in a drier zone.

DISTRIBUTION. Map 31. Tanzania.

MATERIAL EXAMINED.

Holotype ♂, TANZANIA: Amani (*Pringle*), P. 945, iv.1964, BM slide no. 10473, in BMNH.

Paratypes. TANZANIA: 1 ♂, 3 ♀, data as type.

Material not included in type-series. TANZANIA: 1 ♀, Amani, E. Usumbara Mts (*Verdcourt*), xii.1956, in NMK.

Striglina clathrata declivita ssp. n.

(Pl. 1, O; Pl. 30, fig. 164, Pl. 53, fig. 309)

♂. Wing, 10·5–14·5 mm. Morphologically similar to the nominate subspecies, larger, and with differences in the genitalia.

GENITALIA ♂ (Pl. 30, fig. 164). As nominate subspecies but uncus with more rounded sides and shallower median incision. Process on base of valve shorter and broader than nominate subspecies and juxta smoother in outline, without median thickening.

♀. Wing, 14–14·5 mm. As nominate subspecies but larger and with differences in the shape of the ostium.

GENITALIA ♀ (Pl. 53, fig. 309). As nominate subspecies but with smooth edge to the sclerotized ostium.

DISCUSSION. At present this subspecies is known only from one region of Kenya. For separation see under the other two subspecies. Since the Kenyan species is only known from one locality on the edge of the range of the nominate subspecies I am regarding it as a subspecies in spite of some morphological differentiation in the genitalia. This subspecies occurs in a drier locality than the other two subspecies but no information on the biology is available.

DISTRIBUTION. Map 31. Kenya.

MATERIAL EXAMINED.

Holotype ♂, KENYA: Escarpment, B.E.A., ii.[19]01, 6500–9000 ft (*Doherty*), BM slide no. 10476, in BMNH.

Paratypes, KENYA: 19 ♂, 7 ♀, Escarpment, B.E.A., ii–iii.[19]01, 6500–9000 ft (*Doherty*).

THE *STRIGIFERA*-GROUP

This group contains the closely allied species, *S. strigifera*, *S. ferula*, *S. augescere* and *S. trepida*, together with the Indian species, *S. lineola* Guenée. The Indian

species differs from the others in the *strigifera*-group only by the lack of fusion of some of the radial veins in the fore wing.

This species-group is characterized by the fusion of $Sc+R_1$ and Rs in the hind wing for part of their lengths, the eyes are without interfacetal hairs and the tarsi have rows of spines on each segment. The African species of this group are very similar externally and can be separated only by differences in the genitalia.

Striglina strigifera (Strand) comb. n.

(Pl. 8, fig. 31; Pl. 31, fig. 166; Pl. 53, figs 310–312; Text-fig. 10)

Plagiosellula strigifera Strand, 1913 : 62.
Plagiosella strigifera (Strand) Gaede, 1917 : 372.
Plagiosella strigifera (Strand); Gaede, 1929 : 496.
Plagiosellula strigifera Strand; Whalley, 1964a : 124.

♂. Wing, 12–14 mm. Vertex light brown, frons flattened between eyes. Antennae minutely ciliate. Labial palps projecting just beyond frons, slightly longer than diameter of eye, third segment 1/3 length of second. Eyes without interfacetal hairs. Thorax light sandy brown. Hind tibia with proximal pair of spurs shorter and more slender than distal pair. Outer spur of distal pair more than half length of inner spur. Tarsi with spines along length of 1st tarsal segment and 4–6 apical spines on remaining tarsi of hind leg. Fore wing, pattern as in Pl. 8, fig. 31, yellowish brown, prominent median brown line and subterminal line which joins or approaches median fascia near costa, pattern strongly reticulate. Indistinct discal spot. Vein R_4 and R_5 anastomose for a short distance near base. R_3 and R_4 widely separated. $2A$ absent. Underside, pattern as upperside but discal spot prominent. Hind wing, pattern as fore wing. $Sc+R_1$ and Rs join near base for a short distance.

Genitalia ♂ (Pl. 31, fig. 166). Uncus with two lateral spines, with small tuft of hairs at base, lateral finger-like process (socii ?) with hairs. Gnathus with slender arms and central process with peg-like teeth. Valves with numerous long hairs, particularly along posterior margin. Valves produced to strong process at apex, variably spined costa of valve at base produced into rounded papilla with long hairs. Juxta with two prominent lateral arms, saccus reduced, aedeagus with two groups of cornuti. VIIIth sternite of abdomen with sclerotized plate, posterior margin of characteristic shape (Text-fig. 10). Prominent coremata.

♀. Wing, 15–18 mm. Labial palps 2 × diameter of eye, projecting beyond frons. Patterns as in male, generally darker brown colour. Veins R_3 and R_4 free, R_4 and R_5 widely separated.

Genitalia ♀ (Pl. 53, figs 310–312). Prominent toothed signum in bursa. Anal papillae short, VIIIth sternite and tergite modified.

Discussion. Some variation was found in the number of spines on the terminal valve process and in the number of cornuti. It is possible that the cornuti are, in part, deciduous, but there is no direct evidence of this. Some of the specimens from Efulen (Cameroon) are a paler brown than the others, but generally there is little variation in colour. This species is one of a group of closely allied species, all of which are similar externally (although with some variation) but which have differences in the male genitalia. Intraspecifically there is little variation in the male genitalia. It would be possible to regard *strigifera* as a single species with "*s. strigifera*" as the nominate subspecies with the others as subspecies on the edge of its range. However, in Kivu (Democratic Republic of the Congo) specimens of several of the species have been collected near one another. It is not possible to say, on existing data, that they actually fly together although the data on the few specimens available

suggests that they do. In view of the overlap in occurrence (although the habitats are unknown) and, because of considerable differences in the genitalia, this whole group is treated as a species-complex and three new species are described. The basic pattern of the male genitalia is similar in all the species of this complex. Few females are known and all are from the range of *strigifera* and are indistinguishable from one another and are therefore attributed to that species.

DISTRIBUTION. Map 32. Ghana; Cameroon; Rio Muni; Gabon; Democratic Republic of the Congo; Uganda; Angola.

MATERIAL EXAMINED.

Hölotype ♂, RIO MUNI [Spanish Guinea]: BM slide no. 9509, in ZMB.

GHANA: 1 ♂, Takwa (*James*); CAMEROON: 2 ♂, Lomie CI, ix.1962, in NMR; 43 ♂, 2 ♀, Efulen (*Weber*), in CMP; 2 ♂, 1 ♀, Bitje, Ja River, 1915; 2 ♂, 2 ♀, Bitje, Ja River (*Bates*), x., wet season; 1 ♂, Abong-Mbangi, ix.1946, in CMP; 1 ♂, Bitje, Ja River, 2000 ft (*Bates*), dry season; 3 ♂, Lolodorf, 1894–95 (*Conradt*); 6 ♂, Johann Albrechts Höhe (*Conradt*), 1898; 1 ♂, Bitje, Ja River, vi. (*Bates*); GABON: 3 ♂, Belinga, 600 m, Camp Centrale, iii.1963 (*Bernardi*), in MNHN; 1 ♀, Belinga, Savane de Mwadhi, iv.1963 (*Bernardi*) in MNHN; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, 1 ♀, Sankuru, Katako-Kombe, ii–iii.1952 (*Fontaine*), in MRAC; 1 ♂, Kivu, Rwankwi, xii.1951 (*Leroy*), in MRAC; 1 ♀, Equateur, Bokota, x.1928 (*Hulstaert*), in MRAC; UGANDA: 1 ♂, Bundibugyo, Ruwenzori Range, 3440 ft, viii–ix.1952 (*Fletcher*); 1 ♂, Bwamba, Toro, ix.1961 (*Mitton*), in NMK; ANGOLA: 4 ♂, Quicolungo, 120 km N. Lucala, iv–v.1936, 800 m (*Braun*).

Striglina ferula **sp. n.**

(Pl. 8, fig. 32; Pl. 31, fig. 167; Text-fig. 11)

♂. Wing, 13·5–15 mm. Head, thorax etc., as in *S. strigifera*. Wing pattern as in Pl. 8, fig. 32. Fore wing with vein R_4 and R_5 stalked. R_4 widely separated from R_3; R_2 and R_3 running close together for part of length. $1A$ and $2A$ join near base. Hind wing with $Sc+R_1$ and Rs fused for a short distance near base.

GENITALIA ♂ (Pl. 31, fig. 167). Uncus with two long lateral spines with small tufts of hair at base and with small spine on each side of mid-line. Lateral finger-like process with hairs. Gnathus as in *strigifera*. Apical process of valve strongly reflexed with prominent spines. Costal process at base of valve elongate with hairs. Juxta with slender lateral arms. VIIIth sternite of abdomen with sclerotized plate, posterior margin as in Text-fig. 11. Aedeagus with two prominent patches of cornuti.

♀. Unknown.

DISCUSSION. Externally similar to *strigifera* but usually darker in colour. *S. ferula* can be separated from the other species in the group by the shape of the apical process of the valve, the presence of two smaller spines on the uncus and the shape of the costal process of the valve. Only a few specimens have been examined but these tend to be larger than specimens of *strigifera*.

DISTRIBUTION. Map 32. Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♂, DEMOCRATIC REPUBLIC OF THE CONGO: W. Kivu, south side, Middle

Lowa Valley, south of Walikali, 3500 ft, forest, iii.1924, wet season (*Barns*), BM slide no. 10336, in BMNH.

Paratypes. DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, data as type; 1 ♂, W. Kivu, Upper Lowa Valley, nr Masisi, 5000–6000 ft, forest and long grass, ii.1924, wet season (*Barns*); 1 ♂, Middle Lowa Valley, nr Walikali, 3000–4000 ft, forest, wet season, ii.1924 (*Barns*); 1 ♂, Gulukulu, 22.xi.1935 (*Bal*), in MRAC; 1 ♂, Uele, Paulis, ix.1957 (*Fontaine*), in MRAC; 2 ♂, Lomela, Kasai, iv.1959 (*Carcasson*).

Striglina trepida sp. n.

(Pl. 8, fig. 34; Pl. 31, figs 168, 169; Text-fig. 12)

♂. Wing, 13–14·5 mm. Externally as *S. strigifera*. Discal spot slightly less prominent on underside.

GENITALIA ♂ (Pl. 31, figs 168, 169). Uncus bifid with two lateral finger-like processes. Apical process of valve slightly spined. Gnathus as *S. strigifera*. Costal process on margin of valve with one or more arms, one curved, slender, the other toothed at tip. Small tooth on ventral edge of valve near base of apical process. Juxta with two lateral processes, each with strongly toothed inner surface. VIIIth abdominal sternite with sclerotized plate as in Text-fig. 12. Aedeagus with two groups of cornuti.

♀. Unknown.

DISCUSSION: This species cannot be separated on external characters from *S. strigifera* but they differ in the genitalia. *S. trepida* is separated from *S. strigifera* by the bifid basal costal process of the valve, the strongly toothed juxta lobes and the toothed ventral valve margin. Slight variation from the holotype in the shape of the sternite was present in the Congo specimen.

DISTRIBUTION. Map 32. Democratic Republic of the Congo; Republic of the Congo; Uganda; Rwanda.

MATERIAL EXAMINED.

Holotype ♂, UGANDA: Masaka, Katera, Sango Bay, x.1960 (*Carcasson*), BM slide no. 10340, in BMNH.

Paratypes. DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Bena Dibele, Sankuru, Kasai, iv.1959 (*Carcasson*); REPUBLIC OF THE CONGO: 1 ♂, Brazzaville, Mbeokala Forest, by lamp-light, Soil-Zoology Exp., i.1964 (*Enrody-Younga*), in HNHM; UGANDA: 2 ♂, data as type; 2 ♂, Ankole, Kalinzu Forest, xi.1961 (*Carcasson*), one in NMK; 2 ♂, Mabira Forest, Jinja, x.1962 (*Carcasson*), one in NMK; RWANDA: 1 ♂, Ruanda Distr., Rugege Forest, Lake Kivu, 700 ft, xii.1921 (*Barns*).

Striglina augescere sp. n.

(Pl. 8, fig. 33; Pl. 31, fig. 170; Text-fig. 13)

♂. Wing, 11 mm. General morphology as in *S. strigifera*. Pattern as in Pl. 8, fig. 33. Very similar to *strigifera* externally but with discal spots on wing paler. Venation as in *strigifera*.

GENITALIA ♂ (Pl. 31, fig. 170). Uncus with three long spines. Lateral, finger-like process small. Gnathus similar to *strigifera*. Terminal process of valve toothed. Basal process on costa double, strongly sclerotized. One process pointed, other toothed and pointed. Lateral

juxta arms oblique, slightly toothed. VIIIth sternite as in Text-fig. 13. Aedeagus with two groups of cornuti.

♀. Unknown.

DISCUSSION. This species is smaller than *strigifera* but otherwise cannot be distinguished on external characters. The genitalia of these two species are very distinct. The three-spined uncus, prominent toothed costal valve process and the shape of the juxta distinguish *augescere* from all the other species in the complex. The single specimen from Fernan Vaz (Gabon) may represent a distinct species, differing slightly in the structure of the genitalia. When more specimens of the *strigifera*-group are known the relationship of these species may be clearer.

DISTRIBUTION. Map 32. Democratic Republic of the Congo; Gabon; Zambia.

MATERIAL EXAMINED.

Holotype ♂, DEMOCRATIC REPUBLIC OF THE CONGO; W. Kivu [misspelled Klva on label], Lowowo Valley, south side, Lowa Distr., 4000 ft, mountain forest, wet season, iii.[19]24 (*Barns*), BM slide no. 10351, in BMNH.

Paratypes. DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, data as type; 1 ♂, Udamba, Kuila River (*Bousfield*); ZAMBIA: 1 ♂, Mwinilunga, Ksombosombo R., 29.iv.1963, in NMR.

Material not included in the type-series. GABON: 1 ♂, Fernan Vaz, Lake Asebbe, i.[19]08 (*Ansorge*).

GROUP 2

Species in this group have various modifications of the gnathus but never have the peg-like structure found on the gnathus of species in Group 1. There is a tendency for species in Group 2 to have the arms of the gnathus not meeting in the middle but some species have a gnathus with an enlarged median process. Of the species in this group, *S. nigranalis* is a peculiar species with a number of characters in the genitalia not shown by the other species. Eventually this species will probably be placed in a separate genus or subgenus when information on species in other regions is available. For the present, however, *nigranalis* fits into the definition of the genus given on page 66. In Group 2 the first separation (as in Group 1) is based on the fusion or otherwise for part of their lengths of $Sc+R_1$ and Rs. All the species (except *nigranalis*) in Group 2 have R_2 to R_5 from the cell in the fore wing. Interfacetal hairs are present in some species in the group.

THE *VINDICTA*-GROUP

This species-group contains *S. vindicta*, *S. ramosa* and *S. guttistigma*. It is separated from the other species-groups in Group 2 by the separation of $Sc+R_1$ and Rs in the hind wing (fused for part of their length in the other species-groups). *S. guttistigma* differs from the other species in the *vindicta*-group in having interfacetal hairs and tarsi with only paired apical spines, all the others have rows of spines on the tarsi. *S. ramosa* and *S. vindicta* are very similar externally but the genitalia are very distinct. *S. guttistigma* has several characters similar to *S. eguttalis* in Group 1 but the genitalia are distinct.

Striglina vindicta sp. n.

This dark-coloured species is separated into three subspecies, although little material was available for examination. This species can be separated from *S. clathrata* by the shape of the uncus and gnathus. The subspecies are separated on the basis of size and colour and some differences in the genitalia. Externally the Cameroon specimens of *S. vindicta vindicta* can be separated from the Congolese subspecies, *S. v. congolensis* by the size and intensity of colour and in the genitalia by the shape of the juxta. The Ivory Coast subspecies, *S. v. ivoriensis*, is separated from the other two subspecies by its more yellow-brown colour (approaching *S. ramosa* in colour), and by differences in the shape of the juxta and gnathus Without material from the regions between these subspecies, their exact status is in some doubt but the specific difference from *S ramosa* and *S. clathrata* is quite clear.

♂. Antennae ciliate. Labial palps upturned, reaching above vertex, third segment small, less than 1/5 length of second segment. Frons rounded between eyes. Eyes without interfacetal hairs. Hind tibia with scale crest, proximal pair of spurs long, almost reaching to apex of shortest distal spur. Distal spur with outer one 2/3 length of inner spur. Hind tarsi each with rows of spines. Fore wing, pattern and colour see under individual subspecies. Veins R_2 and R_3 very close together, separated more widely from R_4. $1A$ approaches hind margin from the base but then curves inward toward termen. Hind wing, pattern and colour, see under subspecies. $Sc+R_1$ and Rs approach closely, but do not join.

Genitalia ♂ (Pl. 32, fig. 173). Uncus short with enlarged lateral lobes. Gnathus arms with sclerotized process on each side of mid-line. Subscaphium sclerotized with prominent hairy pads. Valves reduced to narrow strips. Lateral lobes of juxta elongate and spiny. Sacculus broad, saccus very reduced. Aedeagus with prominent apical process.

♀. Unknown.

Key to the Subspecies of *STRIGLINA VINDICTA* sp. n.

1	Fore wing golden brown with darker markings. Genitalia as in Pl. 32, fig. 174	***v. ivoriensis*** (p. 78)
–	Fore wing reddish brown or dark brown. Juxta different from Pl. 32, fig. 174 . .	2
2	Fore wing dark reddish brown. Genitalia as in Pl. 32, fig. 173 .	***v. vindicta*** (p. 77)
–	Fore wing very dark brown, genitalia as in Pl. 32, fig. 175 . .	***v. congoensis*** (p. 78)

Striglina vindicta vindicta ssp. n.

(Pl. 7, fig. 25; Pl. 32, fig. 173)

♂. Wing, 10 mm. Vertex brown. Thorax brown. Fore wing, pattern as in Pl. 7, fig. 25, dark reddish brown with broad, dark fascia from apex of fore wing to middle of hind margin of fore wing. Underside more reddish brown, less heavily marked than upperside. Hind wing, darker than fore wing with slightly paler basal area.

Genitalia ♂ (Pl. 32, fig. 173). Lateral lobes of juxta spiny, pointed. Median juxta plate roughly pear-shaped, with small spines. Apex of aedeagus with stout thorn-like process.

♀. Unknown.

Discussion. This subspecies can be separated from *v. congoensis* by its more distinct pattern and by the shape of the gnathus and juxta. The wing shape is similar to *S. clathrata* but differs in not having R_4+R_5 joined in the fore wing and other differences can be seen in the genitalia.

DISTRIBUTION. Map 33. Cameroon.

MATERIAL EXAMINED.

Holotype ♂, CAMEROON: Lolodorf (*Good*), 4.x.1913, BM slide no. 10296, in CMP.
Paratype. CAMEROON: 1 ♂, Lolodorf (*Good*), xi.1913.

***Striglina vindicta congoensis* ssp. n.**

(Pl. 7, fig. 27; Pl. 32, fig. 175)

♂. Wing, 8·5 mm. Morphologically as nominate subspecies. Head dark brown with orange scales. Thorax dark brown. Fore wing (Pl. 7, fig. 27) very dark brown with a few lighter orange-brown spots. Underside orange-brown with darker markings. Hind wings similar.

GENITALIA ♂ (Pl. 32, fig. 175). As nominate subspecies, differing in shape of lateral processes of the gnathus, which are narrower in *v. congoensis*. The lateral process of the juxta is narrower in *v. congoensis* and the median plate broader in this subspecies than in the nominate one. The apical process of the aedeagus is half the length of the rest of the aedeagus in *v. congoensis*, in the nominate subspecies it is only about one-quarter of the length of the aedeagus.

♀. Unknown.

DISCUSSION. This subspecies is closer to the nominate one than it is to *v. ivoriensis* but even so appears sufficiently distinct to be regarded as at least a subspecies. The locality in which it was collected is separated from the locality of the nominate subspecies by some 700 miles, but no specimens have been collected from the intervening area. Further material may suggest that this subspecies deserves specific status.

DISTRIBUTION. Map 33. Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♂, DEMOCRATIC REPUBLIC OF THE CONGO: Equateur, Flandria, 27.ix. 1947 (*Hulstaert*), BM slide no. 10623, in MRAC.

***Striglina vindicta ivoriensis* ssp. n.**

(Pl. 7, fig. 26; Pl. 32, fig. 174)

♂. Wing, 10 mm. Morphologically similar to nominate subspecies. Fore wing, pattern as in Pl. 7, fig. 26, golden brown with darker markings. Underside similar.

GENITALIA ♂ (Pl. 32, fig. 174). As nominate subspecies, differing in shape of juxta, particularly in shape of lateral spiny processes which are more rounded in this subspecies. The apical process on the aedeagus is longer in *v. ivoriensis* than in *v. vindicta*, approximately 1/3 length of aedeagus. Uncus shorter and broader than in nominate subspecies.

♀. Unknown.

DISCUSSION. While this subspecies differs more from the nominate one than *v. congoensis*, there is also a slight difference in the genitalia of the two specimens examined. It is possible that *v. ivoriensis* may be a distinct species but more specimens are needed to assess the variability. Externally *v. ivoriensis* is similar to *S. ramosa* but can be separated by the shape of the uncus, bifid in *ramosa*, single in *v. ivoriensis*.

DISTRIBUTION. Map 33. Ivory Coast; Sierra Leone.

MATERIAL EXAMINED.

Holotype ♂, IVORY COAST: Forêt du Banco, x.1963 (*Piart & Griveaud*), BM slide no. 10630, in MNHN.

Material not included in type-series: SIERRA LEONE: 1 ♂, Bambawa (*Revell*), 13.vi.1969.

Striglina ramosa sp. n.

(Pl. 7, fig. 28; Pl. 32, fig. 176; Pl. 54, figs 313, 314)

♂. Wing, 9·5–11 mm. Vertex brown. Antennae strongly ciliate. Frons rounded, not projecting between eyes, paler than vertex. Labial palps upturned, reaching above vertex, third segment very small, less than 1/5 length of second. Eyes without interfacetal hairs. Thorax dark brown. Hind tibia with large scale tuft, proximal pair of spurs long, reaching nearly to apex of shortest distal spur. Outer spur of distal pair 2/3 length of inner spur. Hind tarsi each with row of spines along length. Fore wing, pattern as in Pl. 7, fig. 28, dark yellowish brown with dark brown fascia from the apex of fore wing to median part of hind margin. Frequently with brown spots over apex of cell (this may be obscured when fascia is dark brown). Underside more yellowish brown, otherwise similar to upperside. Veins R_2 and R_3 very close together, separated more widely from R_4 and R_5, which are also close together. Vein $1A$ approaches hind margin near base of wing but curves inward slightly towards termen. Hind wing, similarly coloured to fore wing, $Sc+R_1$ and Rs approach closely but do not join.

GENITALIA ♂ (Pl. 32, fig. 176). Uncus double. Gnathus a sclerotized loop with two pairs of processes on each side of mid point. Subscaphium sclerotized with hairy median plate. Valve reduced to narrow strip. Basal process a small hairy papilla. Lateral lobes of juxta elongate and hairy and shaped rather like an antler of a deer. Sacculus enlarged as flat lobe. Saccus reduced. Aedeagus with lateral thorn-like process and with a minute tooth near base of process. Apex of aedeagus sclerotized and slightly upturned. Vesica strongly spined. Abdomen with VIIIth sternite deeply incised on posterior margin.

♀. Wing, 11·5 mm. Third segment of labial palp longer than in male, 1/3 length of second segment. Colour and pattern as male.

GENITALIA ♀ (Pl. 54, figs 313, 314). Anal papillae short. Strong development of sclerotized plate over ostium. First part of duct broad, minutely spined, narrowing to rest of duct. Bursa with two broad transverse sclerotized plates covered in spines forming signum.

DISCUSSION. There is some variation in intensity of colour of specimens examined. The labial palps show strong sexual dimorphism. Both sexes have a large scale-crest on the hind tibiae. The male genitalia are very similar in general plan to *S. clathrata* but lack the strongly toothed gnathus of that species. Externally *S. ramosa* is very similar to *S. vindicta* and, except for the differences in the genitalia, is similar in general morphology. There is some variation in the shape of the process in the aedeagus and in other parts of the male genitalia between specimens from Gabon and Cameroon which may be subspecific but with few specimens available these are not yet separated.

DISTRIBUTION. Map 34. Cameroon; Gabon.

MATERIAL EXAMINED.

Holotype ♂, GABON: Kangwe, Ogove River (*Good*), BM slide no. 10627, in CMP.

Paratypes. GABON: 4 ♂, 1 ♀, data as type, 2 ♂, in CMP; CAMEROON: 1 ♂, Efulen (*Weber*), 17.iv.1922, in CMP; 1 ♂, Efulen (*Weber*), 10.iv.1921, in CMP; 1 ♂, Efulen (*Weber*), 22.x.1913.

Striglina guttistigma Hampson

(Pl. 8, fig. 35; Pl. 25, fig. 134; Pl. 31, fig. 171; Pl. 54, figs 315, 316; Text-figs 8, 14)

Striglina guttistigma Hampson, 1906 : 115.
Striglina guttistigma Hampson; Dalle Torre, 1914 : 11.
Striglina guttistigma Hampson; Gaede, 1916 : 370.
Striglina guttistigma Hampson; Gaede, 1929 : 495.

♂. Wing, 14·5–16·5 mm. Vertex brown, frons brown, flattened. Reduced ocelli present. Antennae ciliate, cilia as long as width of each antennal segment. Labial palps with third segment 1/3 length of second. Eyes with long interfacetal hairs. Thorax brown. Hind tibia flattened, with long scent scales, distal pair of spurs shorter than proximal, less than 1/2 length of 1st hind tarsal segment, distal spurs approximately equal in length to one another. Hind tarsi each with pair of spines at distal end. Fore wing, pattern as in Pl. 8, fig. 35, brown with pale, translucent circular area subterminally. Underside paler with slightly pink suffusion. Several dark spots along base of cell and at apex of cell on underside. Radial veins from cell. Hind wing, similar colour to fore wing, paler, with more reticulations showing through the brown and with yellowish brown translucent area in base of hind wing. Underside of hind wing with long, circular reticulations with pink tinge to fringe. Veins $Sc+R_1$ and *Rs* join for a part of their length, separating again near base.

Genitalia ♂ (Pl. 31, fig. 171; Text-fig. 14). Uncus bifid, gnathus with flattened lateral arms, toothed posteriorly, with 2 long pointed and curved lateral projections. Subscaphium with long hairs. Valves modified, juxta simple, lateral arms reduced. Sacculus with prominent median sclerotized arm. Many strongly sclerotized cornuti in aedeagus.

♀. Wing, 16·5–17·5 mm. Colour and pattern as male.

Genitalia ♀ (Pl. 54, figs 315, 316). Anal papillae short, neck and first part of duct strongly sclerotized. Signum a transverse spiny plate in bursa.

Discussion. The number of cornuti in the aedeagus is variable. Some cornuti are shed and can be found in the bursa of the female. The structure of the male and female genitalia is distinct from all other species of Thyrididae. From the female genitalia there are certain similarities to *S. clathrata* Hampson but the structure of the male and various external characters are different. The female has some similarities to *S. eguttalis*, which also has the interfacetal hairs in the eyes. The presence of ocelli is unusual in the Thyrididae but is found in some species of the *humeralis*-group.

Distribution. Map 34. Nigeria; Cameroon; Democratic Republic of the Congo; Gabon; Angola; Rhodesia.

Material examined.

Holotype ♀, Nigeria: R. Niger, Sapele (*Sampson*), BM slide no. 9039, in BMNH.

Nigeria: 1 ♂, Forcados, S. Nigeria, i.1914; 1 ♂, Calabar, i.1914; Cameroon: 1 ♂, Efulen, iv. 1917 (*Weber*), in CMP; Gabon: 1 ♂, Belinga, Bords Ivindo, Plage face, Mwadhi, iii.1963 (*Bernardi*), in MNHN; 1 ♂, Belinga, Savana de Mwhadhi, iii.1963 (*Bernardi*), in MNHN; 1 ♂, 1 ♀, Belinga, 900 m, N. Crete Sud, iii.1963 (*Bernardi*), ♀ in MNHN; Democratic Republic of the Congo: 1 ♀, Lulonga, Hekurihaka, viii.1927 (*Ghésquière*), in MRAC; 1 ♂, Bumba, xii.1948 (*Wikeley*); 1 ♂, Uele, Paulis, viii.1957 (*Fontaine*), in MRAC; 1 ♂, Loile River, Ikela, Equateur, iv.1959 (*Carcasson*); 1 ♂, Elisabethville, xii.1959, in MNHN; 1 ♂, Sankuru, Katako-Kombe, iii.1952 (*Fontaine*), in MRAC; 1 ♂, Upper Lowa Valley, nr Masisi, W. Kivu, 5000–6000 ft, forest and long grass, ii.1924, wet season (*Barns*); Angola: 1 ♂, Guaca, 20 miles E.

of Rio Quanza, alt. 3650 ft, Malange Distr., ii.1931 (*Boulton*), in CMP; 1 ♀, Ceramba, Bihé, iii.1903 (*Bell*); RHODESIA: 1 ♂, Mwinilunga, v.1961, in NMR; 1 ♂, Mwinilunga, Ikelenge, iv.1963, in NMR.

THE *HUMERALIS*-GROUP

This species-group contains four species. It is characterized by the fusion for part of their length of veins $Sc+R_1$ and Rs in the hind wing. All the species in the group have interfacetal hairs in the eyes. *S. nigranalis* has several distinct features which may require a separate subgenus for that species but the first three species are very similar. Small ocelli are present in the first three species in this group.

***Striglina humeralis* sp. n.**

(Pl. 2, M; Pl. 31, fig. 172; Pl. 54, fig. 320)

♂. Wing, 13·5–16·5 mm. Vertex reddish brown, frons rounded. Eyes with interfacetal hairs. Ocelli present, small. Antennae ciliate. Labial palps with third segment 1/4 length of second, upturned, not reaching vertex. Thorax reddish brown. Hind tibia flattened with long scales, each spur with strongly sclerotized tip, proximal pair of spurs almost hidden by long scales. Outer spur of distal pair slightly shorter than inner. Hind tarsi each with pair of spines at distal end. Fore wing, pattern as in Pl. 2, M, reddish brown with yellowish brown terminal and subterminal areas. Faint reticulation visible in terminal area. Radial veins from cell. Underside as upper side, paler. Hind wing brown with pinkish suffusion. Several darker brown transverse bands. Inner fringe pinkish red. Underside as upper side, paler. Veins $Sc+R_1$ and Rs fused for part of length. Median vein faintly visible in cell.

GENITALIA ♂ (Pl. 31, fig. 172). Uncus bifid. Gnathus arms long. Subscaphium with spines. Valves very reduced with prominent scale-tufts. Juxta plate-like with two small lateral arms. Aedeagus with two patches of spines.

♀. Wing, 16–18·5 mm. Wings much darker than male, generally lacking yellow-brown terminal and subterminal areas. Strong reddish suffusion over wing. Antennal ciliations shorter than in male.

GENITALIA ♀ (Pl. 54, fig. 320). Anal papillae short. Genital plate (lamella antevaginalis) highly modified. Transverse signum in bursa.

DISCUSSION. This species shows some similarities with *guttistigma* Hampson. It can be distinguished from that species by the wing pattern and in the genitalia by the almost complete reduction of the valve in the male *humeralis*. In the female the genital plates differ in shape. A specimen of this species was labelled "*Striglina humeralis* type ♂ Warren". No trace of the publication of this name by Warren has been found and it is regarded here as a manuscript name.

DISTRIBUTION. Map 35. Cameroon; Democratic Republic of the Congo; Angola; Zambia; Tanzania.

MATERIAL EXAMINED.

Holotype ♂, ANGOLA: Bihé (Rothschild coll.), BM slide no. 10304, in BMNH.

Paratypes. CAMEROON: 1 ♀, Bitje, Ja River, 2000 ft, dry season (*Bates*), vi–vii.1909; 3 ♂, Efulen (*Weber*), ix–xii.1922, two in CMP; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Uele, Paulis, 25.viii.1957 (*Fontaine*), in MRAC; 1 ♀, Elisabethville, v.1926 (*Seydel*), in MRAC; 2 ♂, Elisabethville, ii–iii.1957 (*Seydel*), in MNHN; 1 ♂,

Katanga, Kolwezi, iv.1964 (*Allard*); 1 ♂, Katanga, Kolwezi, 7.vii.1966, in NMR; 2 ♂, Katanga, Kolwezi, xii.1960 (*Allard*), in NMK; ANGOLA: 1 ♂, Bihé (Joicey coll.); 2 ♀, Bihé; ZAMBIA: 1 ♂, Abercorn, xii.1963–ii.1964 (*Vesey-Fitzgerald*); 1 ♂, Mwinilunga, Zambezi Rapids, 6.v.1963, in NMR; 1 ♂, Ikelenge, Mwinilunga, 27.iv.1963, in NMR; TANZANIA: 1 ♂, Amani (*Pringle*), iii.1963; 1 ♂ (coll. Overlaet), no other data, probably Democratic Republic of the Congo, in MRAC.

Striglina jacanda **sp. n.**

(Pl. 7, fig. 30; Pl. 32, fig. 177; Pl. 54, figs 317–319)

♀. Wing, 16–16·5 mm. Vertex brown. Ocelli well developed, frons flattened between eyes. Antennae minutely ciliate. Labial palps with third segment 1/2 length of second, upturned, just reaching vertex. Eyes with interfacetal hairs. Thorax brown. Hind tibia with sclerotized hook at tip of each spur. Outer spur of distal pair slightly shorter than inner spur. Hind tibia flattened with scale tuft. Hind tarsi each with pair of spines at distal end. Fore wing, pattern as in Pl. 7, fig. 30, brown with dark brown median and costal areas. Strong reticulate pattern subterminally. Underside similar, paler. Radial veins from cell. Hind wing, median fascia narrow, wing with strong reticulate pattern. Veins $Sc+R_1$ and Rs touch at one point on length.

GENITALIA ♀ (Pl. 54, figs 317–319) Anal papillae short. Genital plate highly modified and sclerotized. Small transverse signum.

♂. Wing, 14 mm. Colour and pattern as female but ground colour slightly lighter. Antennae ciliate.

GENITALIA ♂ (Pl. 32, fig. 177). Uncus with lateral processes, brachia long. Juxta with small, spiny, lateral lobes. Valves reduced, with large scale-tufts. Subscaphium lightly sclerotized, spiny. Manica spined. Cornuti very small and slender.

DISCUSSION. The ocelli are well developed in this species. The male described above is only tentatively associated with this species, the pattern and general morphology of it are similar to the female. This species is similar to *tincta*, which is known only from the male (for separation from that species see p. 83).

DISTRIBUTION. Map 35. Ghana; Cameroon; Gabon.

MATERIAL EXAMINED.

Holotype ♀, GHANA: (Rothschild coll.), BM slide no. 9945, in BMNH.

Paratype. CAMEROON: 1 ♀, Bitje, Ja River, 2000 ft, ix–xi.1932, in BMNH.

Material not included in type series. GABON: 1 ♂, Belinga, 600 m, Piste de Mwadhi, 20.iii.1963 (*Bernardi*), in MNHN.

Striglina tincta **sp. n.**

(Pl. 7, fig. 29; Pl. 33, fig. 178)

♂. Wing, 15 mm. Vertex dark brown, frons rounded, scales produced slightly to point. Ocelli present. Antennae ciliate. Labial palps with third segment 1/3 length of second, upturned, reaching vertex. Eyes with interfacetal hairs. Thorax blackish brown. Hind tibia with outer spur of distal pair shorter than inner spur, tibia flattened with large scale tuft. Hind tarsi each with a pair of spines at distal end. Fore wing, pattern as in Pl. 7, fig. 29, blackish brown, reticulations visible subapically and a few reticulations in anteriomedial position. Radial veins from cell. Underside showing more reticulations than upper. Hind

wing black and brown, with darker, somewhat obscure, reticulations. Veins $Sc+R_1$ and *Rs* anastomose shortly. Underside dark brown.

GENITALIA ♂ (Pl. 33, fig. 178). Uncus hairy. Gnathus hooked, with very long arms. Subscaphium hairy. Valve reduced with strong scale tuft present. Juxta two spiny lateral lobes. Aedeagus with spiny manica and no cornuti.

♀. Unknown.

DISCUSSION. This species shows some similarities to *jacanda*. It can be distinguished by the much darker hind wings and the shape of the uncus and other features of the male genitalia. Although only one specimen of this species is known it is sufficiently distinct from *S. jacanda* to warrant description.

DISTRIBUTION. Map 36. Cameroon.

MATERIAL EXAMINED.

Holotype ♂, CAMEROON: Lolodorf (*Good*), 1.ii.1915, Carnegie Mus. acc. 5737, BM slide no. 10303, in CMP.

Striglina nigranalis (Warren) **comb. n.**

(Pl. 2, G; Pl. 30, fig. 161; Pl. 55, figs 321, 322)

Heteroschista nigranalis Warren, 1903 : 271.
Mathoris lenistrialis Hampson, 1906 : 114.
Mathoris monotonicata Strand, 1913 : 60, **syn. n.**
Heteroschista nigranalis Warren; Whalley, 1964a : 120.

♂. Wing, 9–13 mm. Vertex dark brown, frons brown with a few raised scales. Antennae minutely ciliate. Labial palps two and a half times diameter of eye, third segment 1/3 length of second. Eyes with long interfacetal hairs. Thorax reddish brown. Hind leg with long scale tuft on tibia and femur. Outer spur of distal pair on hind tibia slightly shorter than inner spur. Tarsi with several spines on each segment, last tarsal segment with a large group of long spines. Middle two tarsal segments of hind leg short, less than 1/3 length of last hind tarsal segment. Fore wing pattern as in Pl. 2, G, reddish brown with faint reticulate pattern. Underside paler, reticulate pattern more distinct. Veins R_2 and R_3 with common stem. Hind wings, colour and pattern as fore wing. $Sc+R_1$ joins *Rs* for part of its length.

GENITALIA ♂ (Pl. 30, fig. 161). Uncus reduced to two short, pointed lobes. Gnathus with two prominent foreward arms and small posterior projection, covered with long hair-like scales. Valve highly modified with long sacculus process. Juxta reduced to membranous plate with two thorn-like basal processes. Aedeagus with group of long sclerotized cornuti. VIIIth abdominal sternite lightly sclerotized.

♀. Wing, 12–14 mm. Colour and pattern as male. Labial palps with third segment nearly 1/2 length of second segment. Scale tufts on hind legs shorter than in male.

GENITALIA ♀ (Pl. 55, figs 321, 322). Bursa simple; strongly sclerotized and spiny extension of VIIIth sternite round ostium.

DISCUSSION. There is a certain amount of variation in the colour of this species. Some specimens tend to be rather blackish but the majority are a deep reddish brown. This rufous colouration makes the species easily distinguished from other African Thyridids and the genitalia are very characteristic. There is some variation in the shape of the gnathus of specimens from Nigeria and Sierra Leone which may indicate subspeciation. The peculiar structure of the male and female genitalia, together with the hairy eyes, suggest some affinities with *guttistigma* Hampson. The presence of the lateral process on the valve is unusual but is comparable with some of the other modifications found in the genus. It is possible that *S. nigranalis*

will need a genus of its own but a decision on this will have to await study of the world *Striglina* species.

DISTRIBUTION. Map 36. Gambia; Sierra Leone; Liberia; Ivory Coast; Ghana; Nigeria; Cameroon; Rio Muni; Democratic Republic of the Congo; Uganda.

MATERIAL EXAMINED.

Holotype ♂ (*nigranalis*); Warren, in his publication, gives the type locality as "Agberi" [Nigeria], but the specimen with the Warren type label is from Oguta [Nigeria]. No specimens of this species have been found with "Agberi" on the label and the type is here regarded as NIGERIA; Oguta (*Ansorge*), 18.vii.[19]01, BM slide no. 8289, in BMNH. Holotype ♀ (*monotonicata*), RIO MUNI: [SPANISH GUINEA], Alen, Benitogebiet, 1–5.x.[19]06 (*Tessmann*), in ZMB. Holotype ♀ (*lenistrialis*), GHANA (*Johnson*), vi.1900, in BMNH.

GAMBIA: 1 ♀ (ex Joicey coll.); SIERRA LEONE: 1 ♂, Moyamba, v.1903 (*Cator*); 1 ♂, Njala, ix.1933 (*Hargreaves*); 1 ♂ (*Clements*), no other data, in CMP; 1 ♂, Bo (*Revell*), xii.1967; 4 ♂, Bo (*Revell*), i–vii.1969; LIBERIA: 1 ♀, Nimba, Grassfield, iii.1968 (*Forbes-Watson*), in TMP; IVORY COAST: 6 ♀ (ex Joicey coll.); NIGERIA: 1 ♂, 1 ♀, Ogruga; CAMEROON: 1 ♀, Bitje, Ja River, 2000 ft, dry season (*Bates*), vi–vii,1909; 1 ♀, Ja River (*Bates*); DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂ (ex Joicey coll.); 1 ♂, Lusambo (*Fontaine*), i.1950, in MRAC; 1 ♂, Lulua, Ishibaba (*Overlaet*), ix.1933, in MRAC; 1 ♂, 1 ♀, Eala, iii–iv.1936 (*Ghésquière*), in MRAC; UGANDA: 1 ♂, Entebbe, vii.1902 (*Rattray*).

SICULINAE

The characteristics of this subfamily are given on page 16. The subfamily is divided here into two tribes (Rhodoneurini, Opulini) based on the presence or absence of spines on the tarsal segments.

Tarsi with apical pair of spines on each segment .	**RHODONEURINI** (p. 84)
Tarsi without spines	**OPULINI** (p. 106)

Occasionally species are found where there are spines on the last hind tarsal segment but the other segments are without spines; these species are treated as being in the Opulini. One anomalous species, *C. palairantus*, which has spines, is placed in the Opulini for reasons given on page 136.

RHODONEURINI

This tribe is separated from the Opulini by the presence of an apical pair of spines on each tarsal segment.

RHODONEURA Guenée

Rhodoneura Guenée, 1857 : p. 1, fig. 8. Type-species, *Rhodoneura pudicula* Guenée, by monotypy.
Osca Walker, 1864 : 73. Type-species, *O. guttulosa* Walker, by monotypy.
"*Iridesmoides* Bethune-Baker" mis-spelling, see Collins, 1962 : 5.
Rhodoneura Guenée; Whalley, 1964a : 125.
Rhodoneura Guenée; Whalley, 1967 : 19.

The limits of this genus are not clear since they are based here primarily on African and Madagascan species. The division into two subgenera was made when the Madagascan species were examined (Whalley, 1967) but with the examination of all the African species this division is less distinct. There are seven described species of the genus in Africa but several more, represented by a few damaged specimens await description. The species in the genus are not all as closely allied to one another as species in some other genera and an examination of the Indo-Australian species of the genus may help to clear up the problem of the generic limits.

The generic description fits the African species and the presence of a signum is the basis of the separation of the two subgenera. The concept of the genus *Rhodoneura* could be enlarged to include the species at present in *Tridesmodes*, which I retain as a monobasic genus near *Rhodoneura*. *Tridesmodes* seems to provide a link with ***Epaena***, whose species have similar wing venation but seem to have lost (? or not had) the tarsal spines of *Tridesmodes* and *Rhodoneura*.

Generic description. Labial palps 3-segmented. Eyes without interfacetal hairs. Proboscis present. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Hind tarsi each with pair of apical spines or single apical spine. Fore wing with or without some fusion of radial veins. Uncus simple. Gnathus present. Bursa with or without signum.

Key to the Subgenera of *RHODONEURA*

1 Translucent white species with pinkish red suffusion, particularly on terminal margins. Signum in bursa usually spiny . . . . . . ***ISOTHAUMA*** (p. 94)
– Otherwise coloured. White areas, if present, in terminal position, never median or basal. No signum (except *roseola*, Pl. 56, fig. 330) . ***RHODONEURA*** (p. 85)

Subgenus ***RHODONEURA*** Guenée

Rhodoneura Guenée; Whalley, 1967 : 19.

Subgeneric description. Fore wings usually with radial veins from cell, sometimes stalked. Bursa usually without signum.

This subgenus contains six African species but a further species (undescribed) is discussed on page 98. One new species of this subgenus from Madagascar is described here which brings the total to six species of this subgenus in Madagascar.

Biology. No information.

Key to the African Species of *RHODONEURA* (*RHODONEURA*)

1 Wing over 12 mm 2
– Wing under 12 mm 3
2 (1) Terminal and apical areas of fore wing white, median and basal areas without white patches. . . . . ***sordidula*** (p. 86)
– Terminal area of fore wing brown. Median and basal area with white patches ***lacunosa*** (p. 88)
3 (1) Fore wing reddish brown with pinkish suffusion and brown transverse lines, fairly uniformly coloured species . . . . . . ***flavicilia*** (p. 90)
– More patterned species with light areas on fore wing 4

4 (3) Small species, wing under 9 mm. Fore and hind wing with paler areas, very little pinkish red suffusion . . . . ***abacha*** (p. 91)
– Larger species, 9–12 mm wing, strongly patterned and with pinkish red suffusion 5
5 (4) Incomplete median fascia in hind wing and dark mark at hind end of termen of fore wing. Genitalia as in Pl. 34, fig. 185; Pl. 56, fig. 332 . . ***disjuncta*** (p. 93)
– Median fascia of hind wing almost complete. No black at hind end of termen of fore wing. Genitalia as in Pl. 34, fig. 184; Pl. 56, fig. 330 . . ***roseola*** (p. 92)

Rhodoneura (Rhodoneura) sordidula (Plötz)

(Pl. 2, C; Pl. 33, fig. 179; Pl. 55, figs 323, 324)

Siculodes sordidula Plötz, 1880 : 304.
[*Rhodoneura acaciusalis* sensu auct., nec Walker.]
Rhodoneura acaciusalis Walker form *sordidula* Plötz; Gaede, 1929 : 493.

♂. Wing, 14–18 mm. Vertex and frons brown. Antennae strongly ciliate on one side ("monociliate"). Labial palps with third segment 1/3 length of second, upturned, not reaching vertex. Thorax dark brown, black on mesothorax. Hind tibia with outer spur of distal pair 3 × length of inner spur. First four hind tarsi with one apical spine, strongly sclerotized, last hind tarsal segment usually with one pair of spines. Fore wing, pattern as in Pl. 2, C, white and black with strong pink suffusion in terminal area. Median area with dark transverse fascia, patch of red scales over apex of cell and along costal side of cell. Underside with strong red colour along veins, pattern reduced, 6–7 black spots surrounded by silver scales in cell, silver and black scales also along costal margin of cell and along R_1 and part of R_2. Radial veins from cell. $2A$ vestigial, short spur 1/3 from base of $1A$. Hind wing, colour as fore wing, median brown fascia and strong red suffusion along veins. Anterior margin of underside of hind wing with dark stripes.

GENITALIA ♂ (Pl. 33, fig. 179). Uncus simple. Gnathus present, median process with minute spines. Juxta, two rounded lateral lobes backed by narrow plate. Valve simple, basal process sclerotized, with large patch of long scales. Aedeagus with vesica minutely spined.

♀. Wing, 13–17·5 mm. Colour and pattern as male. Labial palps longer than male, reaching above vertex. Last tarsal segment frequently with several spines, other hind tarsal segments with single spine as male.

GENITALIA ♀ (Pl. 55, figs 323, 324). Anal papillae short. Neck of duct sclerotized near ostium, rest of duct broad, covered with small spines. Bursa covered with small teeth-like spines.

DISCUSSION. The main variation in this species is in size and intensity of colouration. In some specimens the red colouration is more extensive on the underside and not restricted to the veins. This species has previously been synonymized with the Indian species, *R. acaciusalis* Walker. Externally these two species are very similarly coloured. Usually *sordidula* is the darker of the two species but otherwise the details of the patterns are very similar. In the males there are small differences in the shape of valve and juxta. The females are not easily separable, *sordidula* tends to be darker than *acaciusalis* but the genitalia are similar. The most striking difference between these two species is in the tarsal spines. In *acaciusalis* there is a pair of these at the distal end of each tarsal segment, in *sordidula* only one spine is present on most tarsal segments; in this it is similar to the Indian species *R. erubescens* Warren, see also page 24. The length of the smaller distal spur varies between specimens of *sordidula* and in some specimens is over half the length of the longer spur.

The similarities between the Indian and African species are so striking that a close common ancestry seems likely, there are too many similar characters to suggest a convergent relationship. The two species are, however, sufficiently distinct to be regarded as species rather than subspecies. Unfortunately no information is available on the food plants of either species.

DISTRIBUTION. Map 44. Guinea; Sierra Leone; Mali; Ivory Coast; Ghana; Nigeria; Fernando Po; Cameroon; Central African Republic; Gabon; Republic of the Congo; Democratic Republic of the Congo; Uganda; Tanzania; Zambia; Malawi; Rhodesia; Mozambique; Angola.

MATERIAL EXAMINED.

Holotype ♀, GHANA: Aburi, ix.1872, not traced. This specimen is not in Berlin (Hannemanni, *in litt.*) nor in Griefswald (Groth, *in litt.*). Both these places have some Plötz types. There is no doubt of the identity of the species described by Plötz, hence no neotype is designated.

MALI: 1 ♀, Koulouba, 1930 (*Waterlot*), in MNHN; GUINEA: 1 ♀, N'zerekore, 1900 ft, vi.1926 (*Collenette*); SIERRA LEONE: 4 ♂, Bo (*Revell*), iii–vii.1967; 1 ♂, Bo (*Revell*), iv.1969; IVORY COAST: 3 ♂, Bingerville, iii–ix.1915 (*Melou*); GHANA: 1 ♂, Kete-Krachi, N. Territories (*Cardinall*); 1 ♀, Accra, x.41 (*Guichard*); 1 ♀, Coomassie [Kumasi] (*Whiteside*); NIGERIA: 1 ♀, Lagos, iii.1963 (*Sutton*); 1 ♀, Ikom, Aboapam, viii.1930; 2 ♂, Warri, v–vii.1897 (*Roth*); 1 ♀, Old Calabar (*Sampson*); 1 ♂, Vom, vi.1960 (*Boorman*); 2 ♂, Ibadan (*Bowden*); FERNANDO PO: 1 ♀ (*Cooper*); 1 ♀ (*Nicholls*); CAMEROON: 34 ♂, 1 ♀, Efulen (*Weber*), 1911–1924, in CMP; 1 ♂, Bitje, Ja River, 2000 ft, x–xi.1912; 1 ♂, Bitje, Ja River, 2000 ft (*Bates*), dry season; 1 ♂, Bitje, iv–v. 1911; 1 ♂, Bitje, Ja River, 2000 ft (*Bates*), 1912, wet season; 2 ♂, 1 ♀, Lolodorf, 1911–24 (Good), in CMP; 1 ♂, Yabassi Distr., Lat. 4°N, Long. 10°E, xii.1937 (*Merfield*), dry season; 1 ♂, xi. (*Schwab*); CENTRAL AFRICAN REPUBLIC: 1 ♂, Fort Crampel (*Le Moult*); GABON: 7 ♂, 1 ♀, 600 m, Camp Centrale, 1962–63 (*Bernardi*), in MNHN; 2 ♂, Makokou, 500 m, iii.1962 (*Bernardi*), in MNHN; 1 ♂, Kangwe, in CMP; REPUBLIC OF THE CONGO: 1 ♀, Mambili Forest, Ouesso, iii.1959 (*Jackson*). in NMK; 1 ♂, Brazzaville, Orstom Park (*Endrody-Younga*), ii.1963, light trap, in HNHM; 1 ♂, Brazzaville, Kindamba, Meya settlement, ii.1963 (*Endrody-Younga*), by lamp-light, in HNHM; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♀, Katanga, Kapenga, viii, 1934; 4 ♂, Elisabethville (*Seydel*), 1950–55, in MRAC; 1 ♀, Lusambo, 29.x.1949 (*Fontaine*), in MRAC; UGANDA; 1 ♂, Ruwenzori Range, Bundibugyo (*Fletcher*), 3440 ft, vii–ix.1952; 1 ♂, Masindi Town (*Kettlewell*), vii.1950; 1 ♂, Kiboga, x.1903 (*Johnston*); TANZANIA: 1 ♂, Ukerewe Is. (*Conradt*), in NMK; 1 ♂, Amani, Usambara, in NMK; 1 ♂, Songea, Savatory, 3800 ft, i.1933 (*Johnston*); 1 ♂, Amani; 1 ♂, Arusha Distr. (*Moore*); ZAMBIA: 1 ♂, Abercorn, i.1956, in NMR; MALAWI: 1 ♂, Lenibe, i–ii.1926 (*Barlow*); 1 ♀, Zomba, iii.1923 (*Barlow*); 4 ♂, 1 ♀, Lake Nyassa, Kasangazi, near Bandawe, 3000 ft (*Prentice*); RHODESIA: 1 ♂, Umtali District, xii.1929 (*Sheppard*), in NMR; 1 ♂, Umtali, i.1927 (*Lennin*), in TMP; 2 ♂, Umvuma, xii.1917 (*Janse*), in TMP; 2 ♂, Xmas Pass, Umtali, ii.1926 (*Lennin*); 1 ♂, Xmas Pass, ii.1925 (*Lennin*), in TMP; MOZAMBIQUE: 1 ♀, Xiluvo, Vila Machado Distr., iii.1964 (*Vari & van Son*), in TMP; ANGOLA: 8 ♂, N'Dalla Tando, 2700 ft, xi.1908 (*Ansorge*);

West Africa: 1 ♂ (*Dudgeon*), and 1 ♀, Bule Country (*Good*), no other data; 5 ♂, 3 ♀, no localities, probably Cameroon, in CMP.

Rhodoneura (Rhodoneura) zurisana **sp. n.**

(Pl. 2, D; Pl. 33, fig. 180; Pl. 55, fig. 325)

♂. Wing, 15–18 mm. Vertex grey-brown, irrorate with white. Frons white, not produced in front of eyes. Antennae ciliate. Labial palps with third segment 1/4 length of second, upturned, just reaching vertex. Patagia and tegulae grey-brown, rest of thorax white. Abdomen with two pinkish red stripes on second segment, edged posteriad with brown, two pinkish red stripes on fourth-fifth segments and base of eighth segment with some pinkish red scales. Hind tibia with outer spur of distal pair less than 1/2 length of inner spur. Legs banded with pinkish red scales. First four hind tarsal segments with one apical spine, last segment with pair of apical spines. Fore wing, pattern as in Pl. 2, D, pinkish red with transverse brown marks and mauve tinge, particularly to antemedial fascia. Veins red. Underside similar, veins more strongly marked with red, black and silver scales in cell. Fringe pink. Radial veins from cell. Hind wing, pinkish red with white fringe, some brown marks in median area near posterior margin. Underside pinkish red, marks near posterior margin obscure. $Sc+R_1$ and *Rs* approach but do not join.

Genitalia ♂ (Pl. 33, fig. 180). Uncus slightly enlarged before apex. Gnathus present, median process with minute spines. Basal process of valve upturned. Juxta with small process on lateral lobes. Vesica with minute spines.

♀. Wing, 18 mm. Colour and pattern as male.

Genitalia ♀ (Pl. 55, fig. 325). Bursa covered with spines, no signum.

Discussion. This species from Madagascar is related to *R. sordidula* Plötz from Africa (see also p. 86). It can be separated from this species by the wing pattern and shape of the basal process on the valve. From the Indian species, *R. erubescens* Warren, which *R. zurisana* broadly resembles, it can be separated by the median brown marks on the hind wing and near the anal angle of the fore wing, which are absent in *R. erubescens*. *R. zurisana* has a single spine on the hind tarsi as found in *sordidula* and *erubescens*. In the key to the Madagascan species of the genus (Whalley, 1967 : 19), *zurisana* comes out in the second couplet with *R. seyrigi* Viette. It can be separated from this species by the lack of the prominent brown patch in the anterior part of the median fascia and the rest of the pattern. The uncus of *seyrigi* is not enlarged below the apex as it is in *zurisana* and *seyrigi* lacks the upturned basal process on the valve.

Distribution. Map 44. Madagascar (East).

Material examined.

Holotype ♂, Madagascar: Baie d'Antongil, Hiaraka, 570 m, 24–25.i.1968 (*Griveaud & Peyrieras*), BM slide no. 10796, in MNHN.

Paratypes. Madagascar: 2 ♂, 1 ♀, data as type, 1 ♂, 1 ♀ in MNHN; 2 ♂, Forêt d'Analabe, 42 km N. de Sambava, 15–20.xi.1960 (*Griveaud, Peyrieras & Viette*).

Rhodoneura (Rhodoneura) lacunosa **sp. n.**

(Pl. 2, B; Pl. 33, fig. 181; Pl. 55, figs 326, 327)

♂. Wing, 14·5–20 mm. Vertex brown with some white scales. Antennae shortly ciliate.

Labial palps equal in length to diameter of eye, upturned, third segment 1/3 length of second. Frons rounded, not projecting between eyes. Thorax brown, heavily irrorate with white scales posteriorly. Hind tibia with outer spur of distal pair 1/2 length of inner. Fore wing, pattern as in Pl. 2, B, reddish brown with oval white areas. These oval areas usually with indistinct brown line in them. Basal area whitish. Termen brown. Fringe reddish brown. Underside similar. Radial veins from cell. Hind wing mostly white, traces of underside pattern showing through. Terminal margin red, fringe white. Underside, darker than upperside, pattern as fore wing, basal area mostly white. $Sc+R_1$ approaches Rs but does not join.

GENITALIA ♂ (Pl. 33, fig. 181). Uncus simple. Gnathus weakly sclerotized with median process. Lateral lobes of juxta rounded. Basal process on valve lightly sclerotized. Valve simple. Aedeagus with small teeth on manica.

♀. Wing, 22 mm. Labial palps with third segment 1/2 length of second. Pattern as male, colour similar, usually with more reddish tinge.

GENITALIA ♀ (Pl. 55, figs 326, 327). Anal papillae short. Ostium lightly sclerotized, duct slightly thickened near ostium. Bursa without signum.

DISCUSSION. Superficially this species has a similar wing pattern to *Opula scardialis* but the white hind wings and the presence of spines on the tarsi immediately separate these two species. *R. lacunosa* is closely allied to *R. limatula* Whalley from Madagascar. The pattern of the Madagascan species consists of small round areas which are silvery in colour. The genitalia of the two species are similar. There are sufficient differences in structure to regard them as distinct species, but they are undoubtedly very closely related. The Tanzanian specimen of *lacunosa* is larger than the holotype and the aedeagus is broader.

DISTRIBUTION. Map 45. Tanzania; Rhodesia.

MATERIAL EXAMINED.

Holotype ♂, RHODESIA: Inyanga, 7000 ft, ii.1961, BM slide no. 9910, in NMR.

Paratypes. RHODESIA: 1 ♀, Inyanga Distr., Pungwe River, 20.i.1951 (*Fitzsimons*), in TMP; 1 ♀, Inyanga, xi.1960, in NMR; 1 ♂, 2 ♀, Inyanga, i.1962, 1 ♀ in NMR; 1 ♂, Inyanga, 1963; 1 ♂, Inyanga, i.1965, in TMP.

Material not included in type series. TANZANIA: 1 ♂, Mbeya, i–iii.1965 (*Robinson*).

Rhodoneura (Rhodoneura) limatula Whalley

Rhodoneura (*Rhodoneura*) *limatula* Whalley, 1967 : 24, figs 35, 58, 59.

DISTRIBUTION. Madagascar. Map 7.

Rhodoneura (Rhodoneura) seyrigi Viette

Rhodoneura seyrigi Viette, 1957 : 172.
R. (*R.*) *seyrigi* Viette; Whalley, 1967 : 20, figs 31, 55.

DISTRIBUTION. Madagascar. Map 44.

Rhodoneura (Rhodoneura) strix Viette

Rhodoneura strix Viette, 1958 : 206.
R. (*R.*) *strix* Viette; Whalley, 1967 : 21, figs 32, 57.

DISTRIBUTION. Madagascar. Map 45.

Rhodoneura (Rhodoneura) superba (Viette)

(Pl. 2, K)

Proterozeuxis superba Viette, 1954.
Rhodoneura (*R.*) *superba* Viette; Whalley, 1967 : 22, figs 33, 54, 70.

DISTRIBUTION. Madagascar. Map 46.

Rhodoneura (Rhodoneura) terreola (Mabille)

Siculodes terreola Mabille, 1880 : cviii.
Rhodoneura (*R.*) *terreola* (Mabille); Whalley, 1967 : 23, figs 30, 50.

DISTRIBUTION. Madagascar. Map 45.

Rhodoneura (Rhodoneura) flavicilia Hampson

(Pl. 1, R; Pl. 9, fig. 41; Pl. 33, fig. 182; Pl. 55, figs 328, 329)

Rhodoneura flavicilia Hampson, 1906 : 121.
Rhodoneura flavicilia Hampson; Dalle Torre, 1914 : 23.
Rhodoneura flavicilia Hampson; Gaede, 1917 : 365.
Rhodoneura flavicilia Hampson; Gaede, 1929 : 493.
Rhodoneura arcuata Gaede, 1929 : 494, **syn. n.**

♂. Wing, 8·5–10 mm. Vertex reddish brown. Antennae moderately ciliate. Labial palps with third segment 1/3 length of second. Thorax reddish brown. Hind tibia with outer spur of distal pair 1/2 length of inner spur, longest spur of distal pair slightly shorter than 1st hind tarsal segment. Fore wing, pattern as in Pl. 1, R, orange-brown with brown transverse lines and reticulations. Costal margin slightly concave in basal third. Terminal margin with brown scales and strong pinky red suffusion over whole terminal area. Underside, orange-brown, paler than upperside. Radial veins from cell. Hind wing, as fore wing. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 33, fig. 182). Uncus simple. Gnathus present. Juxta two small, widely separated, lateral lobes. Valves simple, basal process present. Manica minutely toothed.

♀. Wing, 9–11 mm. Colour and pattern as male. Frequently with more red suffusion over hind wing than male. Labial palps as male.

GENITALIA ♀ (Pl. 55, figs 328, 329). Anal papillae short. First part of duct sclerotized, minutely spined. No signum in bursa.

DISCUSSION. The pinkish red suffusion on the wings of this species is characteristic. In the fore wing the two dark lines on each side of the median area converge near the apex of the cell and, in many specimens, touch for a short distance before diverging again to reach the costal margin separately. Considerable variation in the intensity of the pinkish red suffusion exists and some specimens are more yellow than orange-brown on the underside. The Tanzanian specimens are slightly larger than the South African ones. This species is widespread over southern Africa and usually well represented in collections.

DISTRIBUTION. Map 46. Tanzania; Mozambique; Rhodesia; South West Africa; Botswana; South Africa.

MATERIAL EXAMINED.

Holotype ♀ (*flavicilia*), RHODESIA: Bulawayo, i.1903 (*Eyles*), BM slide no. 9585, in BMNH; Holotype ♂ (*arcuata*), TANZANIA: BM slide no. 9667, in ZMB.

TANZANIA: 3 ♂, 4 ♀, Nachingwea, iv.1961 (*Bigger*), 2 ♂ in NMK; 1 ♀, Mikumi, 1750 ft, Morogoro Distr., ii–iii.1963 (*Marsh*), in NMK; 4 ♂, Iringa, iii.1950 (*Mitton*), 1 in NMK; 1 ♀, Dodoma, iii.1950 (*Mitton*); MOZAMBIQUE: 1 ♀, Rio Save, Massangena, iii.1964 (*Haacke*), in TMP; RHODESIA: 1 ♂, 1 ♀, Wankie, x.1925–26 (*Tyler*), in TMP; 2 ♂, 2 ♀, Sawmills, 1918 (*Janse*), 3 in TMP; 1 ♂, 2 ♀, Maletsi, N. of Wankie, iv.1951 (*Piper*), in TMP; 1 ♂, Darwendale, i.1955 (*Rorke*), in TMP; 1 ♂, Mt Selinda, i.1959 (*van Son*), in TMP; 1 ♀, Khami, Matebeleland, ii.1962, in NMR; 3 ♀, Fort Victoria, ii.1950 (*Mitton*), 1 in NMK; 1 ♂, Victoria Falls, ii.1957, in NMR; 1 ♀, Victoria Falls, i.1918 (*Janse*), in TMP; 1 ♂, Bulawayo, xii.1924 (*Stevenson*), in TMP; 1 ♂, Umvuma, xii.1917 (*Janse*), in TMP; 1 ♀, Gatooma, ii.1957, in NMR; 1 ♀, Changadze River, v.1941 (*van Son*), in TMP; 2 ♂, Chirundu, Zambezi, ii.1950 (*Mitton*), in NMK; 1 ♂, Emangeni, i.1918 (*Janse*), in TMP; SOUTH WEST AFRICA: 1 ♂, Abachaus [160 ml N. of Windhoek], i.1944 (*Hobohm*), in TMP; 3 ♂, Abachaus, i–ii.1943 (Hobohm), in TMP; 1 ♂, Abachaus, iv.1942 (*Meyer*); 1 ♀, Kamanajab, Outjo Distr., iii.1957 (*de Winter & Leistner*), in TMP; 1 ♂, 3 ♀, Ohopoho, Kaokoveld, iii–v.1957 (*de Winter & Leistner*), in TMP; 1 ♂, Ondangua, Ovamboland, ii.1959 (*de Winter*), in TMP; BOTSWANA: 1 ♂, between Palapye and Mahalapye, 25.i.1955 (*Rorke*), in TMP; SOUTH AFRICA: 1 ♀, Transvaal, Waterburg Distr., Zutrzencka, iii.1899 (*Distant*); 3 ♂, 4 ♀, Punda Milia, KNP survey, xii.1964 (*Vari & Potgieter*), 3 ♂ and 3 ♀ in TMP; 6 ♂, 2 ♀, Potgietersrus, Transvaal, 3.ii.1950 (*Mitton*), 4 ♂ in TMP; 1 ♂, Nyandu Bush, KNP survey, xii.1964 (*Vari & Potgieter*), in TMP; 2 ♂, Grootoraai, Olifant R., x.1927 (*Lang*), in TMP; 2 ♂, 1 ♀, Jozini Dam, Lebombo Mts, Natal, xii.1961 (*Vari & Steenstra*), in TMP; 1 ♀, Jozini Dam, Lebombo Mts, Natal, i.1965 (*Vari*); 1 ♂, Zoutpan, Pta., iii.1929 (*van Son*), in TMP; 5 ♀, Letaba camp, KNP survey, xi.1961 (*Vari & Rorke*), three in TMP; 2 ♂, 1 ♀, Limburg, Transvaal, Potgietersrus Distr., xii.1964 (*Vari & Potgieter*), in TMP; 1 ♀, Griffin Mine, i.1915 (*Breijer*), in TMP.

Rhodoneura (Rhodoneura) abacha **sp. n.**

(Pl. 9, fig. 42; Pl. 33, fig. 183)

♂. Wing, 8–8·5 mm. Vertex brown irrorate with white scales. Antennae ciliate. Frons rounded, white, not projecting between eyes. Labial palps with third segment slightly less than 1/2 length of second segment, upturned, almost reaching vertex. Thorax brown. Hind tibia with outer spur of distal pair slightly more than 1/2 length of inner spur. Fore wing, pattern as in Pl. 9, fig. 42, brown with lighter, whitish brown areas. Small white triangle subapically. Fringe light brown. Subterminal area pale whitish brown. Median fascia darker near costa with several round yellowish brown areas in median fascia. Patch of darker scales over apex of cell. Underside paler. Radial veins from cell. Hind wing, colour as fore wing with round patches of whitish brown scales. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 33, fig. 183). Uncus simple. Gnathus a thin sclerotized loop, with short central process, lightly sclerotized. Juxta two simple rounded lobes, small median basal plate with minute spines. Aedeagus with rows of cornuti.

♀. Unknown.

DISCUSSION. Little variation in colour exists in the specimens examined. This small species has some external similarities to *R. disjuncta*. It can be distinguished from this by the pattern and the shape of the basal process on the valve. The

pattern of *abacha* is distinctive and does not closely resemble any other species. Its relationship with the other species may be clearer when the female is known.

DISTRIBUTION. Map 45. South West Africa; Botswana.

MATERIAL EXAMINED.

Holotype ♂, SOUTH WEST AFRICA: Abachaus [160 ml N. of Windhoek] i.1947 (*Hobohm*), BM slide no. 10592, in TMP.

Paratypes. SOUTH WEST AFRICA: 2 ♂, Abachaus i.1945, in TMP; 3 ♂, Abachaus, xii.1945 (*Hobohm*), 2 ♂, in TMP; 1 ♂, Abachaus, i.1950 (*Hobohm*); 1 ♂, Tsumeb, xii.1919 (*Tucker*), in TMP.

Material not included in type-series. BOTSWANA: 1 ♂, Makala-ma-Bedi, Botletle River, 6.11.1967 (*Pinhey*), in NMR.

Rhodoneura (Rhodoneura) roseola sp. n.

(Pl. 1, C; Pl. 34, fig. 184; Pl. 56, figs 330, 331)

♂. Wing, 9–10·5 mm. Vertex brown. Antennae moderately ciliate. Labial palps with third segment less than 1/2 length of second, upturned, not reaching vertex. Thorax brown. Hind tibia with outer spur of distal pair slightly more than 1/2 length of inner spur. Fore wing, pattern as in Pl. 1, C, olive-brown with strong pinkish red suffusion, especially in the terminal area. Terminal area with brown fascia, thin white sinuous line subterminally. Underside more marked with brown transverse lines. Venation variable, some specimens with R_4 and R_5 stalked, some with R_3 and R_4 stalked other specimens with all radials from cell. Hind wing, colour as fore wing, broad median fascia, pinkish red edged on either side with brown, fringe brown, terminal margin pinkish red. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 34, fig. 184). Uncus simple. Gnathus present. Valve simple, basal process a small plate, upturned near base of valve. Juxta with two slightly elongate lateral lobes with spiny apices. Aedeagus with spiny manica.

♀. Wing, 9·5–10·5 mm. Colour and pattern as in male. Labial palps similar to male.

GENITALIA ♀ (Pl. 56, figs 330, 331). Anal papillae short. Small sclerotized part near ostium. Duct covered with minute spines. Bursa spinose with signum a sclerotized plate with inward pointing, toothed, process, usually with three small teeth.

DISCUSSION. Externally this species is similar to *R. disjuncta* Gaede. It can be distinguished from this species by the wing pattern and in the male genitalia by the longer median process to the gnathus and longer lateral arms to the juxta than *disjuncta*. In the females the presence of the signum separates *roseola* from *disjuncta*. The females are generally larger than the males but the range of sizes overlaps. The presence of the signum in the bursa of the female separates this species from all the others in the subgenus and this presence of the signum would suggest that it should be placed in the other subgenus, *Isothauma*, if this character alone is considered. However, *roseola* is so similar in other features to *disjuncta* that I am retaining it in the same subgenus. Very little variation in pattern of *roseola* was found but the origin of the radial veins differs in different specimens, this variation also occurs in specimens of *disjuncta*.

DISTRIBUTION. Map 48. Tanzania; Mozambique; Malawi; Zambia; Rhodesia; South Africa.

MATERIAL EXAMINED.

Holotype ♂, SOUTH AFRICA: Pretoria N., 31.xii.1954 (*Rorke*), BM slide no. 9930, in TMP.

Paratypes. SOUTH AFRICA: 1 ♂, Pretoria N., 20.xii.1954 (*Rorke*); 1 ♂, Pretoria N., ii.1954 (*Malan*); 4 ♂, Pretoria, ii.1954 (*van Son*), in TMP; 1 ♂, Darwendale, i.1955 (*Rorke*), in TMP; 1 ♂, Mahuba Klf., 1050 m, i.1925 (*Janse*).

Material not included in type-series. TANZANIA: 1 ♂, Mukuyu, Kigoma, xi.1962; 1 ♂, Chunya Distr., Chunya, 2650 ft, i.1947 (*Swynnerton*); MOZAMBIQUE: 1 ♂, Garuso, ii.1950 (*Mitton*), in TMP; MALAWI: 2 ♀, Mt Mlanje, xi.1913–i.1914 (*Neave*); ZAMBIA: 1 ♂, Ft Jameson (*Phipps*); 1 ♀, Chidonga, 4000 ft, nr Lundazi, iii.1939 (*Macrae*); RHODESIA: 2 ♂, Mazoe, i.1920 (*Janse*), in TMP; 1 ♀, Marandellas, ii.1961, in NMR; 1 ♂, 1 ♀, Umtali, i.1918 (*Janse*) in TMP; 1 ♂, 1 ♀, Lundi, 13–16.iii.1964 (*Vari & van Son*), in TMP; 1 ♂, Sinoia, ii.1950 (*Mitton*), in NMK.

Rhodoneura (Rhodoneura) disjuncta (Gaede) **comb. n.**

(Pl. 1, B; Pl. 34, fig. 185; Pl. 56, figs 332, 333)

Betousa disjuncta Gaede, 1929 : 496.

♂. Wing, 9–10 mm. Vertex brown. Antennae moderately ciliate. Labial palps with third segment less than 1/2 length of second, upturned, not reaching vertex. Palps approximately equal in length to diameter of eye. Thorax brown. Hind tibia with outer spur of distal pair slightly shorter than inner, longest spur of distal pair only slightly shorter than 1st hind tarsal segment. Fore wing, pattern as in Pl. 1, B, olive-brown with dark transverse fascia and a strong pinkish red suffusion over terminal area. Veins R_3 and R_4 stalked, in some specimens joining to R_2 or R_5. Underside similar to upperside. Hind wings, colour as fore wing, two brown median fasciae, prominent on hind margin becoming less distinct anteriad. $Sc+R_1$ and Rs free, occasionally trace of median vein in cell.

GENITALIA ♂ (Pl. 34, fig. 185). Uncus simple. Gnathus weakly sclerotized. Valve simple, slender near apex, basal process small. Juxta with two rounded lateral lobes. Aedeagus with toothed manica.

♀. Wing, 9–10 mm. Colour and pattern as male. Labial palps similar.

GENITALIA ♀ (Pl. 56, figs 332, 333). Anal papillae short. Duct sclerotized in first part and strongly spiny, rest of duct lightly spined, bursa minutely spined, no signum.

DISCUSSION. This small pinkish coloured species is easily distinguished from most other African species. From *roseola* it can be separated by the incomplete fascia in the hind wing (complete in *roseola*) and the dark marks on the hind end of the termen of the fore wing.

DISTRIBUTION. Map 47. Democratic Republic of the Congo; Tanzania; Malawi; Rhodesia; Angola; South Africa.

MATERIAL EXAMINED.

Holotype ♂, TANZANIA: Tabora, BM slide no. 9654, in ZMB.

DEMOCRATIC REPUBLIC OF THE CONGO: 2 ♂, Sashila R., x.1925; 1 ♂, Elisabethville, xii.1949 (*Seydel*), in MRAC; 1 ♂, Elisabethville, iii.1950 (*Seydel*), in MRAC; TANZANIA: 2 ♂, Sibweza, xi.1962 (*Kielland*); 1 ♂, 1300–1400 m, Matengo-Hochland, WSW. Songea, ii.1936 (*Zerny*), in NMR; 1 ♂, Chunya Distr., Chunya, 2650 ft, i.1947 (*Swynnerton*); MALAWI: 1 ♂, Kasangazi, nr Bandawe, L. Nyassa (*Prentice*), 3000 ft;

RHODESIA: 2 ♂, Umvuma, xii.1917 (*Janse*), in NMR; 1 ♂, Wankie, viii.1925 (*Tyler*); 1 ♂, Hunters Road, xii.1917 (*Whatky*), in NMR; 1 ♂, 1 ♀, Bulawayo, xii.1924 (*Stevenson*), in NMR; 1 ♀, Wankie, xii.1961, in NMR; ANGOLA: 1 ♂, 1 ♀, Bihé, Andulo (*Braun*), xii.1934; 1 ♂, xii.1904 (*Ansorge*); SOUTH AFRICA: 7 ♂, 2 ♀, Punda Milia, KNP survey, 1–5.xii.1964 (*Vari & Potgieter*), five ♂, two ♀ in TMP.

Subgenus ***ISOTHAUMA*** Warren

Isothauma Warren, 1899a : 6. Type-species, *I. opalinula* Mabille, by monotypy.
Rhodoneura (*Isothauma*) Warren; Whalley, 1967 : 25.

This subgenus contains similarly patterned species in Madagascar and one widespread African species. The African species (*serraticornis*) presents many problems in its morphology and distribution in Africa. There appear to be no constant morphological differences between *serraticornis* from widely separated localities in spite of differences in wing pattern. The species is very variable in pattern and colour but the most remarkable feature is a difference between the length of antennal pectinations of some male specimens. I have not found a comparable difference in the females and, since I have specimens with the same collection data but with different lengths for the antennal pectinations, I am retaining this variable group as one species.

SUBGENERIC DESCRIPTION. Fore wing usually with some radial veins joined. Bursa with prominent, usually stellate, signum.

BIOLOGY. No information.

Rhodoneura (Isothauma) serraticornis Warren

(Pl. 2, E, F; Pl. 9, figs 37, 38; Pl. 25, figs 131–133; Pl. 34, figs 186–188; Pl. 56, figs 334–338)

Rhodoneura serraticornis Warren, 1899b : 288.
Iridesmodes [sic] *cymoeasticha* Bethune-Baker, 1911 : 541, **syn n.**
Iridesmodes [sic] *phricosticha* Bethune-Baker, 1911 : 541, **syn n.**
Iridesmoides [sic] *cymoeasticha* Bethune-Baker; Dalle Torre, 1914 : 46.
Iridesmoides [sic] *phricosticha* Bethune-Baker; Dalle Torre, 1914 : 46.
Isothauma serraticornis Warren; Dalle Torre, 1914 : 37.
Rhodoneura phoenicophora Hampson, 1914 : 116, **syn. n.**
Rhodoneura phoenicophora Hampson; Gaede, 1917 : 360.
Tridesmodes cymoeasticha Bethune-Baker; Gaede, 1917 : 373.
Tridesmodes phricosticha Bethune-Baker; Gaede, 1917 : 373.
Isothauma serraticornis Warren; Gaede, 1917 : 368.
Rhodoneura nudicornis Gaede, 1917 : 375, **syn. n.**
Tridesmodes cymaeosticha [sic] Bethune-Baker; Gaede, 1929 : 497.
Tridesmodes phricosticha Bethune-Baker; Gaede, 1929 : 497.
Rhodoneura nudicornis Gaede; Gaede, 1929 : 494.
Rhodoneura phoenicophora Hampson; Gaede, 1929 : 493.
Oxycophina serraticornis Warren; Gaede, 1929 : 495.
Rhodoneura (*Isothauma*) *serraticornis* Warren; Whalley, 1967 : 19.

♂. Wing, 11·5–16·5 mm. Vertex brown, irrorate with white. Antennae bipectinate or simple (see below). Labial palps with third segment 1/3 length of second, upturned, reaching

vertex. Patagia and prothorax brown, rest of thorax white. Hind tibia with outer spur of distal pair slightly less than 1/2 length of inner spur. Fore wing, pattern as in Pl. 9, figs 37, 38; Pl. 2, E, F, translucent white with brown costa and pinkish red suffusion to wing margins and brown transverse striations. Black spots between veins subterminally. Veins R_4 and R_5 joined, or R_2–R_5 from cell. Underside, as upperside. Hind wings, colour and pattern as fore wing. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 34, figs 186–188). Uncus simple, small patch of enlarged scales at base. Gnathus with hooked tip. Juxta, two small rounded lobes. Basal process very small. Valves simple. Aedeagus with spiny manica and larger group of spines in vesica.

♀. Wing, 11·5–18·5 mm. Colour and pattern as male. Labial palps with third segment equal in length to second segment, reaching above vertex.

GENITALIA ♀ (Pl. 56, figs 334–338). Anal papillae short. "V"-shaped ostium, short sclerotized part to duct, wider posterior portion then broad duct covered with minute spines. Signum variable in shape (Pl. 56, figs 335–338), usually stellate and covered with spines.

DISCUSSION. This species is very variable in colour, size and pattern. In a few examples the translucent white ground colour is heavily overlaid with a brown reticulate pattern, in other specimens the reticulate pattern is much reduced with only light transverse fasciae. In almost all the specimens examined the red colour and the black subterminal spots on the fore and hind wings were clearly visible. No geographical trends in distribution were apparent in the different colour patterns of the specimens examined and very few specimens have sufficient data to consider the effect of altitude, time of capture or other factors as possible factors causing the colour variation found. Variation in specimens of this species was not only in pattern and colour but also in some other morphological features. In twelve males (Group B, below), the antennae do not have any pectinations while all the other males (Group A, below) the antennae are strongly pectinate. Although there is some variation in antennal pectination length in Group A, none of them have antennae like Group B specimens. No other differences between these two groups of males was found, the genitalia in the two groups are indistinguishable. Some of the specimens with different antennal structures were from the same localities and had apparently been collected together. No comparable difference was found in the females. In Madagascar, the closely allied species, *R.* (*Isothauma*) *opalinula* Mabille, has the simple (Group B) antennal structure. The Madagascan species is as variable in colour and pattern as the African species but does not apparently have the two antennal forms. The main difference between the Madagascan and African species is in the number and size of the cornuti in the aedeagus of the male. In *serraticornis* the cornuti are numerous and spine-like but in *opalinula* they are short and there are fewer of them. There are also other small differences in the median basal process on the valve but some overlap of these differences occurs. In the female the signum in the bursa of *serraticornis* is generally rounded, in *opalinula* it is elongate.

The significance of the differences in the antennae of this species is not understood. A detailed study of the micromorphological structures on the antennae was undertaken, using the Scanning Electron Microscope. The structure of the antennae of both Groups A and B was similar and some of these structures are shown in Pl. 25, figs 131–133. Apparently the difference is one of growth of the length of the pectination but does not seem to be correlated with the size of the insect.

In the females of *serraticornis* there is some variation in the shape of the signum

(Pl. 56, figs 335–338), and one or two specimens had a very reduced signum. However no significant trend in the reduction of the size of the signum could be found and no other feature could be found to correlate with this.

The amount of variability in this species and in the closely allied Madagascan species make it difficult to assess the whole question of speciation in this complex. At present I feel it is not possible to separate significant subspecies in this complex on the morphological evidence available. I regard the whole African-Madagascan complex as a superspecies in which I separate the Madagascan one on certain constant differences from the African species. This superspecies is in the process of differentiating in Africa, while the more isolated Madagascan population has established some phenotypic differences which are constant and presumably now established in the genotype.

This whole species complex would probably be suitable for a detailed statistical examination on a numerical taxonomic basis.

DISTRIBUTION. Map 7 (Groups A and B).

Group A (strongly bipectinate antennae in male). Senegal; Gambia; Guinea; Ivory Coast; Ghana; Togo; Nigeria; Central African Republic; Democratic Republic of the Congo; Uganda; Kenya; Tanzania; Ethiopia; Sudan; Malawi; Zambia; Rhodesia; Angola.

Group B (very short antennal pectinations in male). Guinea; Nigeria; Democratic Republic of the Congo; Uganda; Kenya.

MATERIAL EXAMINED.

Group A. Holotype ♂ (*serraticornis*), UGANDA: Katagrukwa R., Unyoro, 21.v.[18]97 (*Ansorge*), BM slide no. 9520, in BMNH. Holotype ♂ (*cymoeasticha*), NIGERIA: 100 ml N. of Lokoja (*Cator*), BM slide no. 9717, in BMNH. Holotype ♀ (*phricosticha*), NIGERIA: 100 ml N. of Lokoja (*Cator*), BM slide no. 9522, in BMNH. Holotype ♂ (*nudicornis*), TOGO: Bismarckburg, 15.x.[18]92 (*Conradt*), in ZMB.

SENEGAL: 5 ♀, Sedhiou, vi–viii.1917 (*Castell*); GAMBIA: 1 ♀, Bathurst (*Carter*); 1 ♂ (*Carter*); 1 ♀ (*Moloney*); GUINEA: 7 ♂, 4 ♀, Beyla (*Mrázek*), six ♂, four ♀ in MMB; IVORY COAST: 6 ♀ (ex Joicey coll.); GHANA: 1 ♀, Gambaga (*Bury*); 5 ♂, 9 ♀, N. Territories, Kete-Krachi (*Cardinall*); 1 ♂, Bolgatange, v.1962 (*Lewis*); NIGERIA: 2 ♀, Abinsi, River Benue, vi.1912; 1 ♀, Ogruga; 1 ♀, Zungeru, 26.iv.1911 (*Scott-Macfie*); 1 ♀, Zungeru, 23.x.1910 (*Scott-Macfie*); 2 ♀, Zungeru, 28.iii.1911 (*Simpson*); CENTRAL AFRICAN REPUBLIC: 4 ♂, 2 ♀, Fort Crampel (*Le Moult*); DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♀, Kafakumba, 4.i.1925; 1 ♂, Kafakumba, ii.1923 (*GFO*); 1 ♂, Luvua River (East bank), 85 miles N. of L. Mweru, 3000 ft, end of wet season, iv.1922 (*Barns*); 2 ♂, Dungu, Upper Uelle Distr., iv; 4 ♂, 1 ♀, Elisabethville, vii.1951–xii.1956 (*Seydel*), in MNHN; 2 ♂, Kolwezi, Katanga, x.1960 (*Allard*); 1 ♂, Lulua, Sandoa, iv.1931 (*Overlaet*), in MRAC; 1 ♀, Haut-Uele, Motoalrima, xii.1926 (*Burgeon*), in MRAC; KENYA: 2 ♂, Kibwezi, v.1960 (*Carcasson*), in NMK; 1 ♂, Kitale, xii.1961 (*Dougall*), in NMK; 1 ♂, 1 ♀, Yatta Kitui, iv.1960 (*Carcasson*); 4 ♀, Kitale, v.1925–iv.1931 (*Jeffery*); 1 ♂, Kitale, vi–viii.1951 (*Howard*), in NMK; 5 ♂, Suna, S. Kavirondo, xi.1931–v.1932 (*Feather*); UGANDA: 1 ♂, Madi Opei, Acholi, iii.1952 (*Jackson*); 1 ♀, Unyoro, Wakibara, xi.1907 (*Ansorge*); 1 ♀, Dokolo, Lango,

xi.1933 (*Johnston*), at light; TANZANIA: 1 ♂, Arusha (*Moore*); ETHIOPA: 1 ♂, Harar, ix.1937 (*Ellison*); 1 ♂, Harar, 21.v.1939 (*Ellison*); 1 ♀, Harar, 21.iv.1939 (*Ellison*); SUDAN: 1 ♂, Tambura, Southern Bahr-el-Ghazal; 1 ♂, 3 ♀, Tambura, xii.1922; MALAWI: 1 ♂, Zomba Plateau, vii.1920; 1 ♂, Mlanje Distr., iii–iv.1925 (*Barlow*); 1 ♂, 1 ♀, Lenibe, i–ii.1926 (*Barlow*); 1 ♂, Limbe (*Barlow*); ZAMBIA: 1 ♀, Ndola, iv.–v.1960, in NMR; 1 ♂, 1 ♀, Bwana Mkubwa, xii.1920 (*Gardner*), in TMP; RHODESIA: 1 ♂, Gatooma, xii.1955, in NMR; 1 ♂, Darwendale, 17–19.i.1955 (*Rorke*), in TMP; ANGOLA: 1 ♂, Bange Ngola, 5.x.1903 (*Ansorge*); 4 ♂, 4 ♀, Mt. Moco, Luimbale, 1800–1900 m, 15–20.iii.1934 (*Jordan*); 4 ♂, Caiala, Bihé, 1–3.xii.1904 (*Ansorge*); 1 ♂, Andulo, Bihé, xii.1934 (*Braun*).

Group B. Holotype ♂ (*phoenicophora*), NIGERIA: N. Nigeria, Minna, 27.ix.1910 (*Macfie*), BM slide no. 9517, in BMNH.

GUINEA: 2 ♂, Beyla (*Mrázek*), one ♂ in MMB; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Kolwezi, Katanga, viii.1966; UGANDA: 2 ♂, Mabira Forest, iv–viii. 1919 (*Dummer*), in TMP; KENYA: 1 ♂, Kapeka vii.1933 (*Johnston*), at light; 4 ♂, Suna, S. Kavirondo, v.1930–ii.1932 (*Feather*); 1 ♂, Kitale, iv.1936 (*Jeffery*).

Rhodoneura (Isothauma) opalinula (Mabille)

Siculodes opalinula Mabille, 1879 : 347.
R. (*I.*) *opalinula* (Mabille) Whalley, 1967 : 26, figs 25, 27, 48, 63.

DISTRIBUTION. Madagascar. Map 7.

Rhodoneura (Isothauma) marojejy Viette

Rhodoneura marojejy Viette, 1960 : 70.
R. (*I.*) *marojejy* Viette; Whalley, 1967 : 29, figs 34, 56.

DISTRIBUTION. Madagascar. Map 46.

Rhodoneura (Isothauma) werneburgalis (Keferstein)

Pyralis werneburgalis Keferstein, 1870 : 16.
R. (*I.*) *werneburgalis* (Keferstein) Whalley, 1967 : 30, figs 23, 24, 47, 60.

DISTRIBUTION. Madagascar; Seychelles. Map 47.

This species was discussed in detail by Whalley (1967). Since then a single female specimen labelled "Ost-Afr. ca. 1885, Mahé" has been located. If the label on the specimen is correct, this is the first record of a Madagascan Thyridid species outside that island and the Comoro Is. One other specimen of *werneburgalis* labelled "S. Africa" is in the BM collection but the label has been queried. It is possible that *werneburgalis* is widespread, the closely allied *zophocrana* has a species complex ranging from Madagascar over the Seychelles and Mascarene regions.

Rhodoneura (Isothauma) zophocrana Viette

Rhodoneura (*Isothauma*) *zophocrana* Viette, 1957 : 173.
R. (*I.*) *zophocrana* Viette; Whalley, 1967 : 32, figs 29, 51, 64.

DISTRIBUTION. Map 47. Madagascar; Comoro Is.

Rhodoneura sp. near ***zophocrana*** Viette

(Pl. 9, figs 39, 40)

A few specimens of a species which is similar externally to *zophocrana* have been found in collections from South Africa, Angola and Rhodesia. While the males are similar in genitalia to *zophocrana*, the females of the African specimen lack a signum. A series of specimens from the Seychelles (Pl. 9, fig. 40) are also similar to *zophocrana* in genitalia but much lighter in pattern. The *zophocrana-mellea* species complex (Whalley, 1967) needs examination of more specimens to determine the exact status of the African and Seychelles specimens. Until more material is available I do not propose to describe them.

Rhodoneura (Isothauma) mellea (Saalmüller)

Siculodes mellea Saalmüller, 1881 : 442.
R. (*I.*) *mellea* (Saalmüller) Whalley, 1967 : 33, figs 28, 49, 65.

DISTRIBUTION. Madagascar. Map 46.

Rhodoneura (Isothauma) translucida Viette

Rhodoneura translucida Viette, 1954 : 119.
R. (*I.*) *translucida* Viette; Whalley, 1967 : 34, figs 22, 46, 61.

DISTRIBUTION. Madagascar. Map 48.

Rhodoneura (Isothauma) elegantula Viette

Rhodoneura elegantula Viette, 1957 : 174.
R. (*I.*) *elegantula* Viette; Whalley, 1967 : 35, figs 21, 62.

DISTRIBUTION. Madagascar. Map 48.

SYMPHLEPS Warren

Symphleps Warren, 1897 : 383. Type-species, *S. atomosalis* Warren, by original designation.
Symphleps Warren; Dalle Torre, 1914 : 46.
Symphleps Warren; Gaede, 1917 : 374.
Symphleps Warren; Gaede, 1929 : 498.
Symphleps Warren; Whalley, 1964a : 126.
Symphleps Warren; Whalley, 1967 : 17.

Only one species of this genus is known from Africa (*S. suffusa*), but in Madagascar a closely allied species, *S. seta* Viette, occurs. The genus *Symphleps* consists of these two species with two or three species from the Oriental region.

Symphleps at present consists of species with similar external appearance and similar female genitalia but with rather diverse male genitalia. The generic affinities are not clear, several African genera having $Sc+R_1$ and Rs joining in the hind wing and the thorn-like signum, typical of species of *Symphleps*, also occurs in the genus *Hypolamprus*.

GENERIC DESCRIPTION. Labial palps three-segmented. Eyes without interfacetal hairs. Proboscis present. Antennae minutely ciliate. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Hind tarsi each with a pair of apical spines. Fore wing with R_3 and R_4 fused for part of length, often with R_2 joined to R_3+R_4. Hind wing with $Sc+R_1$ and Rs fused for part of length. Female with thorn-like signum in bursa.

BIOLOGY. No information.

Symphleps suffusa Warren

(Pl. 8, fig. 36; Pl. 34, fig. 189; Pl. 56, figs 339, 340)

Symphleps suffusa Warren, 1898b : 226.
Symphleps signicostata Strand, 1913 : 60. (Syn. by Gaede, 1917 : 359.)
Symphleps suffusus Warren; Dalle Torre, 1914 : 47.
Symphleps suffusus Warren; Gaede, 1917 : 359.
Symphleps suffusus Warren; Gaede, 1929 : 498.
Symphleps suffusus Warren; Whalley, 1967 : 17.

♂. Wing, 9·5–10·5 mm. Vertex and frons brown. Labial palps with third segment 1/4 length of second segment, not reaching vertex. Thorax brown. Hind tibia with inner spur of proximal pair long, 2 × length of outer spur. Fore wing, pattern as in Pl. 8, fig. 36, yellowish brown with white maculations. Fringe brown, underside similar but greyer. Veins R_3+R_4 off common stem of $R_2+R_3+R_4$. Hind wing, colour and pattern as fore wing. $Sc+R_1$ and Rs join for part of length.

GENITALIA ♂ (Pl. 34, fig. 189). Uncus clavate. Gnathus with small median projection. Juxta, two clavate lobes with a few spines at apex. Valve simple. Aedeagus with mass of spines in vesica. VIIIth abdominal sternite slightly incised on posterior margin.

♀. Wing, 10·5–11·5 mm. Colour and pattern as male. Labial palps similar to male.

GENITALIA ♀ (Pl. 56, figs 339, 340). Anal papillae slightly elongate. Duct broad, narrowing half way along length. Bursa minutely spinose, large, inward projecting, sclerotized spine which itself is covered with minute spines.

DISCUSSION. Externally this species is similar to *S. atomosalis* Walker, from Indonesia but the genitalia are different. The Madagascan species, *S. seta*, is very similar to *S. suffusa* but has only R_3+R_4 joining in the fore wing, whereas the African species has three of the radial veins joining.

DISTRIBUTION. Map 6. Sierra Leone; Ghana; Nigeria; Cameroon; Gabon; Rio Muni; Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♀ (*suffusa*), NIGERIA: Warri, ix.[18]97 (*Roth*), BM slide no. 9611, in BMNH; LECTOTYPE ♂ (*signicostata*), here designated, RIO MUNI: [Spanish Guinea], Alen, in ZMB.

SIERRA LEONE: 1 ♂, 1 ♀, Moyambe (*Cator*); GHANA: 1 ♂, Coomassie [Kumasi] (*Whiteside*); 1 ♀, Kumasi (*Sanders*); NIGERIA: 1 ♂, Warri, vi.1897 (*Roth*); CAMEROON: 1 ♂, 2 ♀, Bitje, Ja River, x (*Bates*), wet season; 4 ♂, 2 ♀, Bitje, Ja River; 1 ♂, Efulen (*Weber*), in CMP; 1 ♂, 1 ♀, Batanga (*Good*), in CMP; GABON: 1 ♂, Kangwe, Ogove R. (*Good*), in CMP; 1 ♀, Kangwe; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Bena Dible, Sankuru, Kasai, iv.1959 (*Carcasson*), in NMK; 1 ♂, Eala, vi.1936 (*Ghésquière*), in MRAC; 1 ♂, 2 ♀, no data, in CMP (probably Cameroon).

Symphleps seta (Viette)

Proterozeuxis seta Viette, 1958 : 208.
Symphleps seta (Viette) Whalley, 1967 : 18, figs 18, 42.

DISTRIBUTION. Madagascar. Map 6.

HAPANA Whalley

Hapana Whalley, 1967 : 37. Type-species: *Hypolamprus verticalis* Warren, by original designation.

Two of the species (*verticalis* and *carcealis*) are very similar in pattern but the third African species (*minima*) differs in pattern and some other characters and is only tentatively placed in this genus.

The Madagascan species, *H. milloti* Viette, although very similar to *H. verticalis* externally, differs in lacking the tarsal spines. It is interesting that two apparently very closely related species should show this particular difference, in other species in the family differences in the presence or absence of spines on the tarsi are often linked with other fairly major differences.

This genus can be separated from *Hypolamprus* by the fusion of $R_3 + R_4$ in the fore wing (these arise from the cell in *Hypolamprus*). From *Rhodoneura* it is less clearly separated, the main difference being in the type of signum in the female. Possibly when more species of the genus *Rhodoneura* are examined the relationship of these two genera may be clearer.

The genus *Hapana* is at present known from Madagascar, Aldabra, Mauritius, Africa and North India but possibly other species from the Indo-Australian region should be placed in this genus. The Indian species, *Hapana obscuralis* Hampson **(comb. n.)** is very similar to *H. verticalis*. The males are indistinguishable externally and the genitalia are very similar. There are differences in the female in the shape of the ostium and in the bursa. These two species are closely allied and probably relatively recently separated from a common ancestor. The Aldabran specimens of *H. carcealis* are more distinct from the mainland specimens of this species than the mainland ones are from specimens from Mauritius. It is possible that the Aldabran specimens should be separated as a distinct subspecies but more information on this species and the allied Madagascan species, *H. millotti* Viette, is needed.

GENERIC DESCRIPTION. Eyes without interfacetal hairs. Labial palps 3-segmented. Proboscis present. Antennae minutely ciliate. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Usually one pair of apical tarsal spines. Fore wing with R_3+R_4 (not R_2+R_4 as given in error in the original description, Whalley, 1967 : 37). Uncus simple. Female with signum in bursa.

BIOLOGY. No information.

KEY TO THE AFRICAN SPECIES OF *HAPANA*

1 Very small (6–7 mm wing), reddish brown, small white mark subapically, more clearly visible on underside. Male genitalia with long median process on gnathus. Aedeagus with minute spines. Female with twin signa in bursa **_minima_** (p. 103)

– Small (7–10 mm wing), reddish or grey-brown, no white mark subapically. Male genitalia without median process on gnathus. Aedeagus with group of large spines. Female with single signum 2

2 (1) Hind wing with reddish brown patch, often obscuring pattern, on inner margin. Apex of juxta lobes of male pointed, median basal process strongly upturned. Female with rounded patch of spines forming signum . ***carcealis*** (p. 102)

– Hind wing without dark patch, pattern clear to inner margin. Apex of juxta lobes of male rounded, median basal process not upturned Female with elongate patch forming signum . . . . . ***verticalis*** (p. 101)

Hapana verticalis (Warren)

(Pl. 10, fig. 43; Pl. 35, fig. 191; Pl. 57, figs 343, 344)

Hypolamprus verticalis Warren, 1899b : 288.
Hypolamprus verticalis Warren; Dalle Torre, 1914 : 16.
Hypolamprus verticalis Warren; Gaede, 1917 : 371.
Betousa verticalis (Warren) Gaede, 1929 : 495.
Hapana verticalis (Warren); Whalley, 1967 : 37.

♂. Wing, 7·5–9·5 mm. Vertex reddish brown, frons white, irrorate with red, flattened between eyes. Labial palps with third segment 1/3 length of second, upturned, reaching vertex. Thorax reddish brown. Hind tibia with outer spur of distal pair 1/2 length of inner. Inner spur of distal pair equal to length of 1st hind tarsal segment. Fore wing, pattern as in Pl. 10, fig. 43, reddish brown with darker brown transverse fascia. Underside paler. Vein R_1 dips down towards R_2 then turns away toward *Sc*, leaving broad area between R_1 and edge of cell. Hind wing, colour and pattern similar to fore wing, frequently with dark terminal margin. $Sc+R_1$ and *Rs* approach but do not join.

Genitalia ♂ (Pl. 35, fig. 191). Lateral arms of gnathus not joined in mid-line. Number of spines in aedeagus variable. Median basal process of valve with rounded upper (morphologically posterior) margin.

♀. Wing, 9·5–10·5 mm. Colour and pattern as male. Third segment of labial palps 1/2 length of second.

Genitalia ♀ (Pl. 57, figs 343, 344). Neck of duct swollen, ostium with few small spines. Two patches of spines forming signa in bursa, these patches are variable in size.

Discussion. Specimens of this species show variation in intensity of colour and pattern. Specimens from the Cameroon have a slight difference in the shape of the median basal process but are otherwise indistinguishable. These Cameroon specimens are not as distinctive from the more typical *H. verticalis* specimens as specimens of *H. carcealis*, where there is also a difference in the shape of the lateral process of the juxta. It is probable that some subspeciation has taken place in *H. verticalis* but at present the differences are small over the whole range and I do not propose to describe new subspecies. Externally this species is practically indistinguishable from *H. carcealis* but it can be separated by the genitalia in both sexes. The female genitalia of *H. verticalis* show some variation in the number of spines in the signum and in the size of the actual patch of spines itself. Certain morphological trends were apparent but were not constant in the material examined. For example the signa of the South African specimens tend to be more clearly defined than other specimens. Three other specimens have a much stronger spine in the signum, these come from Angola, Sierra Leone and Uganda. When more specimens

of this species are available for examination it may be possible to identify the subspecific trends more closely.

DISTRIBUTION. Map 43. Sierra Leone; Ghana; Ivory Coast; Nigeria; Sudan; Cameroon; Gabon; Democratic Republic of the Congo; Uganda; Kenya; Tanzania; Mozambique; Rhodesia; Angola; South West Africa; South Africa.

MATERIAL EXAMINED.

Holotype ♂, NIGERIA: Anambara D., Niger R., in BMNH (abdomen missing).

SIERRA LEONE: 1 ♀ (*Clements*), vi.1895; 1 ♂, Bo (*Revell*), vii.1967; 1 ♀, Bo (*Revell*), x.1968; 1 ♀, Bo (*Revell*), iv.1969; GHANA: 1 ♂, Accra; IVORY COAST: 2 ♂, Bingerville (*Melou*), 1915; 1 ♂, Adiopodoume, ix.1964 (*Piart & Griveaud*), in MNHN; NIGERIA: 1 ♀, Anambara Creek, Niger; 1 ♀, Agoue, Benin, 1884 (*Menager*); 1 ♂, U.C. Ibadan, 8.v.1958 (*Sutton*); SUDAN: 5 ♂, W. Dafur, N. Jebel Murra, Kurra, 5600 ft, vii.1932 (*Steele*); CAMEROON: 1 ♂, Bitje, Ja River, 1920; 1 ♂, 3 ♀, Efulen (*Weber*), 1912–22, in CMP; GABON: 1 ♂, Lake Azingo (*Ansorge*), xii.1907; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♀, Elisabethville, xii.1934 (*Seydel*), in MRAC; 1 ♀, Kil de Kindu, nuit (*Russo*), in MRAC; UGANDA: 1 ♂, Bwamba (*Carcasson*), v.1956, in NMK; 4 ♂, Ruwenzori Range, Bugoye, 4500 ft (*Fletcher*), ix.1952; 1 ♀, Kayonza, Kigezi (*Jackson*), v.1957; KENYA: 1 ♂, 2 ♀, Tiwi, Mombasa, iv–v.1957 (*Carcasson*), one ♀, in BMNH, one ♂, one ♀, in NMK; 1 ♂, Mombasa I., x.1896 (*Ansorge*); 1 ♀, Mombasa (*Doherty*), in CMP; TANZANIA: 1 ♀, Moshi, ii–iii.1950 (*Pinhey*), in NMK; 1 ♀, Nachingwea, iv.1961 (*Bigger*), in NMK; 2 ♂, Dar-es-Salaam; 1 ♀, Dar-es-Salaam, Morogoro, 100 m, 2000 ft, at foot of Uluguru Mt (*Loveridge*), ii.1917; 2 ♀, Kilwa, i–xi.1900 (*Reimer*); MOZAMBIQUE: 1 ♀, Port Amelia (*Beste*); 1 ♂, Chiluvo Hills, Vila Machado, xi.1967 (*Pinhey*), in NMR; RHODESIA: 1 ♂, 1 ♀, Marandellas, x.1960, in NMR; 1 ♂, Balla-Balla, xii.1955, in NMR; 2 ♂, 2 ♀, Bulawayo, Matopos, Maleme Dam, xii.1967 (*Pinhey*), in NMR; 1 ♀, Khami, Matabeleland, i.1962, in NMR; 1 ♂, Khami, nr Bulawayo, xii.1955; 1 ♀, Darwendale, i.1955 (*Rorke*), in TMP; ANGOLA: 1 ♂, Benguella, Fort Quilenges (*Ansorge*), i.1904; SOUTH WEST AFRICA: 2 ♂, 2 ♀, Abachaus, i.1944 (*Hobohm*), in TMP; 1 ♀, Abachaus, iii.1945 (*Hobohm*), in TMP; 1 ♀, Abachaus, xii.1945 (*Hobohm*); 1 ♂, Abachaus, ii.1946 (*Hobohm*); SOUTH AFRICA: 2 ♂, 1 ♀, Wylie's Poort, ii.1920 (*Swierstra*), two ♂ in TMP; 1 ♀, Kransberg, ii.1932 (*van Son*); 1 ♀, Elandshoek, xi.1946 (*Capener*), in TMP; 1 ♂, Nelspruit, x.1917 (*Breijer*); 1 ♂, Pretoria, iii.1915 (*Janse*), in TMP; 1 ♂, Potgietersrus, Powei, i.1939 (*Janse*), in TMP; 1 ♂, Chunies Poort, xii.1925 (*Janse*), in TMP; 1 ♂, P. P. Rust, xii.1924 (*Janse*), in TMP; 1 ♂, Barberton, x.1922 (*G.v.D.*), in TMP; 1 ♀, Barberton, i.1911 (*Janse*), in TMP.

Hapana carcealis **sp. n.**

(Pl. 1, F; Pl. 10, fig. 44; Pl. 35, fig. 192; Pl. 57, figs 341, 342)

[*Betousa obscuralis* sensu Vinson, 1938 : 39, nec Hampson.]
[*Betousa obscuralis* auct., nec Hampson.]
[*Hypolamprus obscuralis* sensu Legrand, 1967 : 87, nec Hampson.]

♂. Wing, 7·5–10 mm. Vertex grey-brown, flattened, produced slightly between base of antennae. Frons flattened, whitish. Labial palps with third segment 1/3 length of second, upturned, reaching vertex. Thorax, tegulae and patagia light grey-brown. Hind tarsi with

outer spur of distal pair slightly more than 1/2 length of inner spur. Inner spur of distal pair equal to length of 1st hind tarsal segment. Fore wing, pattern as in Pl. 1, fig. F, yellowish brown with transverse markings. Underside brown. Vein R_1 approaches R_2 half way along length but does not join. Hind wing, pattern variably obscured by reddish brown patch. Underside generally darker than underside of fore wing. Veins $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 35, fig. 192). Lateral arms of gnathus not joined in middle. Median basal process with spines near apex. Juxta with lobes strongly spined at apex. Aedeagus with group of 4–6 cornuti.

♀. Wing, 8·5–10 mm. Colour and pattern as male, generally less red on hind wings and more transverse pattern showing. Labial palps with third segment 1/2 length of second.

GENITALIA ♀ (Pl. 57, figs 341, 342). Ostium broad, spiny. Neck of duct sclerotized but not swollen as in *verticalis*. Large patch of spines forming signum.

DISCUSSION. Specimens of this species from the mainland are larger and more heavily patterned than the specimens from Aldabra (Pl. 10, fig. 44). The specimens from Mauritius are intermediate in size between the mainland and Aldabran species. When more material is available it may be desirable to separate off the Aldabran and Mauritian specimens as new subspecies but for the present, with the overlap of characters, they are being retained as one species. Externally this species is very similar to *H. verticalis* but in the male can be separated by the large reddish brown patch on the hind wing of *carcealis*, and the genitalia are different. In *carcealis* the juxta is spined at the apex and the median basal process is spined and upturned, whereas in *verticalis* the apex of the juxta is smooth and the median basal process is not upturned. Generally there are less cornuti in the aedeagus of *carcealis* than *verticalis*.

DISTRIBUTION. Map 42. Tanzania; Kenya; Malawi; Rhodesia; Aldabra; Mauritius.

MATERIAL EXAMINED.

Holotype ♂, KENYA: Nairobi, xi.1957 (*Carcasson*), BM slide no. 10006, in BMNH.

Paratypes. KENYA: 1 ♀, data as type; 2 ♂, 1 ♀, Nairobi, iv.1961 (*Carcasson*), one ♂, one ♀ in NMK; 1 ♂, Nairobi, iv.1958 (*Carcasson*); 1 ♂, Nairobi, iii.1958 (*Carcasson*); 2 ♀, Nairobi, xii.1959 (*Carcasson*); 1 ♂, West Suk, Kacheliba, vii.1961 (*Jackson*), in NMK.

Material not included in the type-series. TANZANIA: 1 ♂, 1 ♀, Dar-es-Salaam; 1 ♂, 1 ♀, Amani (*Pringle*), iv.1964; MALAWI: 1 ♀, Nkata Bay, ii.1962, in NMR; RHODESIA: 1 ♂, Wankie (*Tyler*), iii.1925, in TMP; 1 ♂, Umvuma, xii.1917 (*Janse*), in TMP; 1 ♂, Sawmills, ii.1918, in TMP; SEYCHELLES: 1 ♂, 2 ♀, Aldabra, Sladen Trust Exped. (*Fryer*); 4 ♀, Aldabra, Oc. Indiano, xi.1953, three ♀ in MNHN; 1 ♀, Aldabra, S. Island, Cinq Cases, 23–29.i.1968 (*Cogan & Hutson*), at light; MAURITIUS: 1 ♂, Curepipe (*Carie*), i.1903, in MNHN; 1 ♂, Curepipe, i.1904 (*Carie*), in MNHN; 1 ♀, Curepipe, ii.1904 (*Carie*); 1 ♂, 1 ♀, Curepipe, 23–24.i.1911 (*Carie*), in MNHN; 1 ♂, Curepipe, i.1926 (*Carie*); 1 ♀, Rose-Hill, 20.v.1949 (*Orian*); 2 ♀, Rose-Hill, 17.i.1949 (*Orian*).

***Hapana minima* sp. n.**

(Pl. 10, fig. 45; Pl. 35, fig. 193; Pl. 57, figs 345–347)

♂. Wing, 6·5 mm. Vertex and frons brown. Labial palps equal in length to diameter of eye, third segment slightly smaller than second. Patagia reddish brown. Thorax brown.

Hind tibia with outer spur of distal pair slightly more than 1/2 length of inner spur. Legs and spurs with brown and red alternate stripes. Fore wing pattern as in Pl. 10, fig. 45, brown with darker brown reticulations. Underside, as upper but with a few patches of silvery grey and iridescent scales. Small white patch on apex extending shortly down terminal margin on underside. Hind wing, colour and pattern as fore wing, $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 35, fig. 193). Uncus simple. Gnathus with median process. Valve simple. Median basal process with teeth, strongly sclerotized and upturned. Juxta, two lightly sclerotized lateral lobes. Aedeagus with minute spines on manica.

♀. Wing, 7–8 mm. Colour and pattern as male.

GENITALIA ♀ (Pl. 57, figs 345–347). Anal papillae simple. Duct lightly sclerotized. Bursa with two large, inward projecting, plate-like spines.

DISCUSSION. Some variation in pattern exists in the specimens examined. This species differs from the others in the genus in several ways, particularly in the presence of the twin signa in the bursa. In this it is similar to the genus *Hypolamprus* but that genus lacks the tarsal spines. At present this species is known from few localities and small differences are apparent in the specimens from these different localities. No close affinities for this species can be suggested but most of the morphological characters are similar to the other species of *Hapana*. The female *minima* differs in lacking the thickenings of the duct shown by the other species in the genus. The specimens from Mozambique are slightly different from the holotype, the female has a single signum in the bursa with only a trace of the second one.

DISTRIBUTION. Map 42. Cameroon; Mozambique; Angola.

MATERIAL EXAMINED.

Holotype ♂, ANGOLA: Fazenda Congulu, Amboim Distr., 700–800 m, 17–22.iv.1934 (*Jordan*), BM slide no. 9582, in BMNH.

Paratypes. ANGOLA: 1 ♂, 1 ♀, data as type; 1 ♂, 1 ♀, Fazenda Congulu, Amboim Distr., iv.1934 (*Jordan*); 4 ♀, Quirimbo, 75 km E.P. Amboim, 7–12.v.1934 (*Jordan*); 1 ♂, Canhoca, 23.xi.1903 (*Ansorge*); 1 ♀, N'Dalla Tando, 2700 ft, 22.xi.1908 (*Ansorge*).

Material not included in the type-series, MOZAMBIQUE: 2 ♂, 1 ♀, Chiluvo Hills, Vila Machado, 13.xi.1967 (*Pinhey*), 2 in NMR; 1 ♂, Amatonga Forest, Gondola, 14.xi.1967 (*Pinhey*); CAMEROON: 1 ♂, Efulen (*Weber*), xi.1917, in CMP.

Hapana milloti (Viette)

Betousa milloti Viette, 1954 : 121.
Hapana milloti (Viette) Whalley, 1967 : 38, figs 11, 75.

DISTRIBUTION. Madagascar. Map 42.

Additional material. MADAGASCAR: 3 ♂, 1 ♀, Betroka (*Diehl*), 4.xi.1953.

TRIDESMODES Warren

Tridesmodes Warren, 1899b : 290. Type-species, *T. ramiculata* Warren, by original designation.
Tridesmodes Warren; Whalley, 1964a : 127.

The single species in this genus is similar to some of the species in the genus *Rhodoneura*, differing in fore wing venation and the enlargement of the saccus of the

male. Externally *T. ramiculata* looks very similar to *R. serraticornis*. *Tridesmodes* forms a link between the genus *Epaena* where the fore wing venation is similar and *Rhodoneura* with which it shares some common characters. Some of the species of *Epaena* also have the enlarged saccus found in *Tridesmodes* but the two genera can easily be separated by the presence or absence of spines on the tarsal segments. The genus *Tridesmodes* is only known from the mainland of Africa.

GENERIC DESCRIPTION. Labial palps 3-segmented. Eyes without interfacetal hairs. Proboscis present. Fore wing with $R_3+R_4+R_5$. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Tarsi each with a pair of spines at distal end. Male genitalia without gnathus, saccus enlarged. Female with bursa minutely spined.

BIOLOGY. Specimens of *T. ramiculata* examined had been bred from larvae rolling leaves of *Terminalia ivoriensis* in Nigeria.

Tridesmodes ramiculata Warren

(Pl. 10, fig. 46; Pl. 34, fig. 190; Pl. 58, figs 348, 349)

Tridesmodes ramiculata Warren, 1899b : 290.
Tridesmodes ansorgei Warren, 1901a : 6, **syn. n.**
Tridesmodes ansorgei Warren; Dalle Torre, 1914 : 39.
Tridesmodes ramiculata Warren; Dalle Torre, 1914 : 39.
Tridesmodes ramiculata Warren; Gaede, 1917 : 373.
Tridesmodes ansorgei Warren; Gaede, ibid.
Tridesmodes ramiculata Warren; Gaede, 1929 : 497.
Tridesmodes ansorgei Warren; Gaede, ibid.
Tridesmodes ramiculata Warren; Whalley, 1964a : 127.

♂. Wing, 10–12·5 mm. Vertex and frons brown. Antennae minutely ciliate. Labial palps with third segment 1/2 length of second, upturned, not reaching vertex. Thorax white, irrorated with brown. Hind tibia with outer spur of distal pair nearly 2 × length of inner spur. Outer spur 2/3 length of 1st hind tarsal segment. Legs with black and white scales in alternate rings. Fore wing, pattern as in Pl. 10, fig. 46, translucent white with dark brown costal margin and brown reticulations. Small black dots between veins subapically. Vein R_5 off common stalk of R_3+R_4. Underside, pattern darker than upperside, some veins coloured red. Hind wings, colour and pattern as fore wing. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 34, fig. 190). Uncus simple, with small dorsal hump. Gnathus absent. Base of valve with long scales, basal process ending in strong toothed knob. Juxta spiny at apex, two strongly sclerotized lateral lobes. Saccus very elongate. Aedeagus with group of 14–30 strong spines, frequently with further sclerotization of vesica.

♀. Wing, 10–11 mm. Colour and pattern as male. Labial palps long, reaching well in front of head, third segment slightly shorter than second, palps 2 × diameter of eye. Often more red in veins on underside than in male.

GENITALIA ♀ (Pl. 58, figs 348, 349). Anal papillae short. Ostium spiny, first part of neck of duct spiny, bursa minutely spined.

DISCUSSION. Externally this species is similar to *R. serraticornis* but there is much less red on the upperside of the wings of *ramiculata* and the genitalia are quite distinct. This species has been bred from *Terminalia ivoriensis*, where the larvae rolled the leaves. Some variation in size and pattern occurs, the Ugandan specimens tend to have fewer cornuti in the aedeagus than the West African specimens but the cornuti may be deciduous. The male specimens from the Congo are larger

than the other specimens and have the lateral juxta arms more sclerotized. They may represent a distinct subspecies.

DISTRIBUTION. Map 41. Guinea; Sierra Leone; Liberia; Ivory Coast; Ghana; Nigeria; Central African Republic; Democratic Republic of the Congo; Uganda; Malawi.

MATERIAL EXAMINED.

Holotype ♂ (*ramiculata*), UGANDA: Masindi, 1.i.1898 (*Ansorge*), BM slide no. 8511, in BMNH. Holotype ♂ (*ansorgei*), UGANDA: Mondo, 11.iii.1899 (*Ansorge*), BM slide no. 9519, in BMNH.

GUINEA: 3 ♂, Zoubouroumai, 15 ml. SE. Macenta, 2000 ft, 23.v.1926 (*Collenette*); SIERRA LEONE: 1 ♂, 1 ♀, Bo, iii.1967 (*Revell*); 1 ♂, 1 ♀, Bo, iv.1967 (*Revell*); 1 ♀, Bo, i–iii.1969 (*Revell*); LIBERIA: 2 ♀, Nimba, Grassfield, vi–vii.1967 (*Forbes-Watson*); IVORY COAST: 1 ♀, Aedguie, ix.1964 (*Griveaud*), in MNHN; GHANA: 1 ♂, Winnebah, 30.i.1940, in CMP; 1 ♂, 1 ♀, N. Territories, Kete-Krachi (*Cardinall*); NIGERIA 2 ♂, 1 ♀, Sapoba, Benin, ex *Terminalia ivoriensis*, ix.1962; 1 ♀, Sapoba, ex *Terminalia ivoriensis*, vii.1968; 1 ♀, Ife-Ikeji, ex *Terminalia ivoriensis* vi.1968; CENTRAL AFRICAN REPUBLIC; 1 ♂, Fort Crampel (*Le Moult*); DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Dungu, Upper Uelle Distr., vii.; 1 ♂, Lulua, Kapanga, 1933 (*Overlaet*), in MRAC; UGANDA: 3 ♂, Mabira Forest, Jinja, x.1962 (*Carcasson*), two ♂ in NMK; MALAWI: 1 ♀, Zomba Plateau, 1920 (*Barlow*).

OPULINI

This tribe is separated from the Rhodoneurini by the absence of spines on the tarsal segments (see page 84). In a few species, spines may be present on the last tarsal segment of the hind leg.

EPAENA Karsch

Epaena Karsch, 1900 : 245. Type-species, *Epaena elephantinalis* Karsch, by monotypy.
[*Tridesmodes* auct., nec Warren.]
Epaena Karsch, Whalley, 1964a : 120.

This genus, which contains eight species, is divided into three species-groups.

This whole genus is rather heterogeneous and may well be further subdivided when more specimens are studied and more information about species in other faunae is available. The genitalia of *E. trijuncta* are slightly different from the rest of the species in the genus. At present the species of the genus are only known from the mainland of Africa. *Epaena* possesses certain characters which make it a possible link in the *Rhodoneura-Tridesmodes* group of genera. *Epaena* differs from both these genera in lacking tarsal spines but it does have the same veins fused in the fore wing as *Tridesmodes* and a similar shaped gnathus and general wing colour and pattern to some species of *Rhodoneura*.

GENERIC DESCRIPTION. Labial palps 3-segmented. Eyes without interfacetal hairs. Proboscis present. Antennae, ciliate, minutely ciliate or bipectinate. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Tarsi without spines. Fore wing usually with some fusion

of radial veins, R_3+R_4, $R_3+R_4+R_5$ or $R_2+R_3+R_4$, rarely with veins from cell. Gnathus usually present. Female without signum.

BIOLOGY. No information.

KEY TO THE SPECIES-GROUPS OF *EPAENA*

1	Saccus of male enlarged. R_5 frequently joined to R_3+R_4 in fore wing, occasionally all veins free	***TRIJUNCTA***-Group (p. 107)
–	Saccus not elongate. Fore wing with R_5 free from R_3+R_4	2
2	Fore wing with R_2 joined to R_3+R_4	***INOPS***-Group (p. 108)
–	R_2 free from R_3+R_4	***DANISTA***-Group (p. 111)

THE *TRIJUNCTA*-GROUP

Only one species is placed in this group. The fore wing venation is very variable but usually has $R_3+R_4+R_5$ joined near the cell and the male has an elongate saccus. There is some variation in the wing venation between different specimens and the three radial veins are not always fused. However, in the male the elongate saccus separates this species from the others in the genus. The single species in this group has white wings and shows some similarity in shape of the genitalia and in the anastomosing of the radial veins to *Tridesmodes ramiculata* but differs from this species in lacking the tarsal spines.

Epaena trijuncta (Warren) **comb. n.**

(Pl. 11, figs 49, 50; Text-fig. 7; Pl. 35, fig. 195; Pl. 58, figs 350, 351)

Dixoa trijuncta Warren, 1898a : 5.
Epaena elephantinalis Karsch, 1900 : 246, **syn. n.**
Dixoa trijuncta Warren; Dalle Torre, 1914 : 9.
[*Rhodoneura multipunctata* sensu Gaede, 1917 : 366, nec Hampson.]
Symphleps trijuncta (Warren) Gaede, 1917 : 373.
Tridesmodes elephantinalis (Karsch); Gaede, 1929 : 497.
Symphleps trijuncta (Warren); Gaede, 1929 : 498.
Epaena elephantinalis Karsch; Whalley, 1964a : 120.

♂. Wing, 12–15 mm. Vertex brown, tufts of scales on frons projecting slightly between eyes. Labial palps upturned, just reaching vertex, third segment less than 1/2 length of second. Patagia brown, rest of thorax white irrorate with brown. Hind tibia with outer spur of distal pair nearly 2× length of inner spur. Legs white with black transverse bands. Fore wing, pattern as in Pl. 11, fig. 50, translucent white with brown costal margins. Black spots on terminal margin between veins. Median fascia obscure except on hind margin where there are variable numbers of brown scales. Underside, median fascia more distinct. More brown scales than on upperside. Terminal margin with almost complete brown line. Veins R_3 and R_4 joining R_5 or $R_2+R_3+R_4$, usually near cell. Hind wing similar colour to fore wing. Veins $Sc+R_1$ and *Rs* free, the latter very weak near base of wing.

GENITALIA ♂ (Pl. 35, fig. 195). Uncus simple. Gnathus with strongly hooked median process. Valves simple, basal process sclerotized. Juxta with two pointed sclerotized lateral lobes. Saccus elongate. Aedeagus with apical process, small spine on manica behind apical process.

♀. Wing, 14·5–19·5 mm. Colour and pattern as male. Labial palps 2× diameter of eye, projecting well in front of head. Third segment more than 1/2 length of second segment.

GENITALIA ♀ (Pl. 58, figs 350, 351). Anal papillae short, ostium and first part of duct sclerotized, duct and bursa without spines.

DISCUSSION. This species is almost certainly a complex of two or more subspecies. Considerable variation in size was found in specimens from the same locality; otherwise they were indistinguishable. Variation in pattern tends to lead to a reduction in the amount of the dark reticulations and to an increase in the intensity of the median mark on the hind margin of the fore wing (Pl. 11, fig. 49). Wing venation is variable, usually $R_3+R_4+R_5$ but in some specimens R_5 is free or $R_2+R_3+R_4$ and occasionally the partial fusion of R_5 with the other two veins has given rise to a small areole in the fore wing. The male genitalia show little variation in the specimens examined. In some specimens the juxta has a slightly toothed edge, otherwise few differences could be found between the males. The ostium of the female varies in both length and the amount of sclerotization and it is from these characters that I suspect that some degree of subspeciation has occurred. However, in the specimens examined no constant trend was found and no subspecies are described at present. From all the other males in the genus this species can be separated by the shape of the juxta, saccus and by the long process on the apex of the aedeagus.

DISTRIBUTION. Map 37. Sierra Leone; Liberia; Ghana; Nigeria; Cameroon; Gabon; Democratic Republic of the Congo; Angola.

MATERIAL EXAMINED:

Holotype ♀ (*trijuncta*), NIGERIA: Warri (*Roth*), iv.[18]97, BM slide no. 9993, in BMNH. Holotype ♂ (*elephantinalis*), CAMEROON: BM slide no. 9559, in ZMB.

SIERRA LEONE: 1 ♂, Bo, 25.x.1959 (*Taylor*); 1 ♂ (*Frère*); 1 ♂ (no other data); 1 ♂, vii.1895; 1 ♂, Njala, vi.1932 (*Hargreaves*); LIBERIA: 1 ♂, Harbel, Marshall Terr., 31.xii.1956 (*Fox*), in CMP; GHANA: 1 ♂, Nsaba, v.1922 (*Bell*); 1 ♂, Sekondi (*Hamlyn*); NIGERIA: 2 ♂, Warri (*Roth*), iv.[18]97; 1 ♂, U.C. Ibadan, vi.1958 (*Sutton*); 1 ♂, Lagos (*Strachan*); CAMEROON: 9 ♂, 5 ♀, Efulen (*Weber*), six ♂, four ♀ in CMP; 1 ♂, 1 ♀, Bitje, Ja River, 2000 ft, ix–xi.1932; 1 ♀, Bitje, in USNM; 1 ♂, Lolodorf, xii.1913 (*Good*), in CMP; GABON: 1 ♀, Belinga, 600 m, Camp Centrale, v.1963 (*Bernardi*), in MNHN; 1 ♂, Makokou, Bords Ivindo, Rapides, Buwaka, v.1963 (*Bernardi*), in MNHN; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Eala, vii.1937 (*Ghésquière*), in MRAC; 1 ♂, Sankuru, Dimbelenge, ii.1951 (*Fontaine*), in MRAC; 1 ♂, Sankuru, Dimbelenge, x.1950 (*Fontaine*), in MRAC; 1 ♀, Opala, Lomami R., Prov. Orientale (*Carcasson*), iii.1959, in NMK; ANGOLA: 1 ♀, Bihé; 2 ♂, no data, in CMP (probably CAMEROON).

THE *INOPS*-GROUP

This contains the next three species, which have $R_2+R_3+R_4$ joined near the cell in the fore wing. All these species have white wings. The females of two of the species are unknown. In *E. inops*, two colour phases are known (p. 109).

KEY TO THE *INOPS*-GROUP

1 Hind margin of fore wing with black mark. Genitalia of male as in Pl. 36, fig. 197 **pellucida** (p. 110)

– Fore wing without obvious black marks on hind margin. Genitalia not as above . . . 2
2 Valve of male broad, gnathus with minute spines . . . . . ***inops*** (p. 109)
– Valve of male narrowing near apex. Gnathus without spines . ***candida*** (p. 110)

Epaena inops (Gaede) comb. n.

(Pl. 11, fig. 51; Pl. 35, fig. 194; Pl. 58, figs 352, 353)

Symphleps inops Gaede, 1917 : 382.
Symphleps inops Gaede; Gaede, 1929 : 498.

♂. Wing, 12·5–21 mm. Vertex brown, frons bulbous with tuft of scales protruding slightly between eyes. Labial palps with third segment more than 1/2 length of second, upturned, just reaching vertex. Patagia brown. Thorax white, irrorate with brown. Hind tibia with inner spur of distal pair long, more than 2 × length of outer spur. Inner spur slightly more than 1/2 length of 1st hind tarsal segment. Fore wing, pattern as in Pl. 11, fig. 51, white with brown reticulations (white phase). Underside reticulations darker with brown costal, terminal and apical margins. Veins R_3 and R_4 anastomosing, arising from common stem of $R_2+R_3+R_4$. Veins 1*A* and 2*A* join near base to form single vein to wing margin. Hind wing, colour and pattern as fore wing. $Sc+R_1$ and *Rs* approach but do not join.

Genitalia ♂ (Pl. 35, fig. 194). Uncus simple. Gnathus with median process covered with small spines. Valve simple, basal process sclerotized, slightly hooked. Juxta two rounded lobes with broader plate at 90° to them. Aedeagus with spiny vesica and small spines on manica.

♀. Wing, 20–24 mm. Colour and pattern as in male. Labial palps with third segment 1/3 length of second. Venation as male.

Genitalia ♀ (Pl. 58, figs 352, 353). Anal papillae short. Ostium and duct slightly enlarged and sclerotized. Duct spiny.

Discussion. This species occurs in two colour phases. One phase is completely white with brown pattern, the other is brown with a darker brown pattern. The genitalia of these two phases are similar and intermediates between the two extremes occur. The pattern is variable but the reticulations are generally paler than in the other white African Thyridids. This species also varies in size and in the intensity of pattern and will probably be separated into subspecies when more material is available. The Angolan and Cameroon specimens are smaller and with more intense pattern than the Rhodesian or Congo ones but the genitalia are similar. Unlike some of the other species in the genus, no variation in the origin of the radial veins was found.

Distribution. Map 38. Cameroon; Democratic Republic of the Congo; Tanzania; Zambia; Angola.

Material examined.

Holotype ♂, Tanzania: Udjidji, BM slide no. 9676, in ZMB. Cameroon: 1 ♂, Efulen (*Weber*), v.1917, in CMP; 1 ♂, Bitje, Ja River, 200 ft, x–xi.1912; Democratic Republic of the Congo: 1 ♂, 1 ♀, Katanga, Kolwezi, x.1954 (*Allard*); 1 ♂, Katanga, Tenke, vii–viii.1931 (*Cockerell*); 1 ♂, Katanga, Jadotville, viii.1965 (*Coussement*); Zambia: 1 ♂, Abercorn, xi.1963 (*Vesey-Fitzgerald*), in NMK; 1 ♀, Chingola, ii.1960, in NMR; 1 ♂, Mpiko, iii–vii.1921; 2 ♂, 1 ♀, Kitwe, 2–27.xii.1954 (*Kruger*), one ♂, one ♀, in TMP; 1 ♂, 1 ♀, Ndola, xii.1960, in NMR; Angola: 1 ♂, Gamba, Bihé, xii.1934 (*Braun*); Andulo, Bihé, xii.1934 (*Braun*).

Epaena candida sp. n.

(Pl. 11, fig. 52; Pl. 35, fig. 196)

♂. Wing, 12–18 mm. Vertex brown, frons slightly raised between eyes. Labial palps with third segment 1/3 length of second, upturned, not reaching vertex. Patagia brown. Thorax white. Hind tibia with outer spur of distal pair 1/2 length of inner spur. Inner spur of distal pair less than 1/2 length of 1st hind tarsal segment. Long scent scales on hind tibia. Fore wing, pattern as in Pl. 11, fig. 52, translucent white with yellowish brown costa and transverse markings. Small black spots subapically between veins. Veins R_3 and R_4 anastomose, joining R_2 near cell. Hind wing, colour and pattern as fore wing but without brown costal marks. Veins $Sc+R_1$ and Rs approach but do not join. Rs vestigial at base.

GENITALIA ♂ (Pl. 35, fig. 196). Uncus simple. Gnathus with long median process. Juxta with two pointed lateral lobes. Basal process on valve small. Valve simple. Aedeagus with row of teeth on each side of manica.

♀. Unknown.

DISCUSSION. This species is similar externally to *E. pellucida* but lacks the black patch in the middle of the hind margin of the fore wing. The two species can also be separated by the shape of the basal process of the valve (very reduced in *candida*) and by the narrow band of teeth alongside of the manica (a broad band in *pellucida*). The valve of *pellucida* is rounded while in *candida* it is more pointed. The juxta of *candida* is pointed, with few spines while *pellucida* has a rounded juxta with many spines. There is variation in the origin of R_2 in some specimens, a considerable amount of variation in the pattern and small differences in the genitalia (mainly in the juxta) between specimens from different localities. The single specimen from the Congo probably represents a distinct subspecies and the Tanzanian specimen is also fairly distinct from the holotype. However, with so few specimens I do not propose to describe subspecies.

DISTRIBUTION. Map 38. Ivory Coast; Ghana; Democratic Republic of the Congo; Tanzania; Mozambique.

MATERIAL EXAMINED.

Holotype ♂, GHANA: Coomassie [Kumasi] (*Whiteside*), BM slide no. 9996, in BMNH.

Material not included in the type-series. IVORY COAST: 1 ♂, Adiopodoumé, xii.1963 (*Griveaud*), in MNHN; 1 ♂, Ldmto, vii.1964 (*Gillon*), in MNHN; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, S. side, middle Lowa Valley, South of Walikali, Kivu, 3500 ft, forest, wet season, iii.1924 (*Barns*); TANZANIA: 1 ♂, Morogoro, Kimboza, iv.1954 (*Pinhey*), in NMK; 1 ♂, Dar-es-Salaam, Minaki, iii.1965; MOZAMBIQUE: 2 ♂, Rikatla, Junod, xii.1918 (*Janse*), one ♂ in TMP.

Epaena pellucida sp. n.

(Pl. 11, fig. 53; Pl. 36, fig. 197; Pl. 58, figs 354, 355)

♂. Wing, 9·5–11·5 mm. Vertex brown, frons brown, not protruding between eyes. Labial palps with third segment 1/3 length of second, upturned, not reaching vertex, length of palp equal to diameter of eye. Patagia brown. Thorax white. Hind tibia with outer spur of distal pair 1/2 length of inner; inner spur of distal pair 1/2 length of 1st hind tarsal segment. Fore wing pattern as in Pl. 11, fig. 53, translucent white with dark costal margin, lightly marked reticulate pattern and prominent black spot in median area on hind margin. Subterminal row of small black spots between veins. Veins R_3 and R_4 anastomosing, joining stem of

$R_2+R_3+R_4$. Hind wing, colour and pattern as fore wing but without black marks. $Sc+R_1$ and *Rs* approach but not joining.

GENITALIA ♂ (Pl. 36, fig. 197). Uncus simple. Gnathus with long median process. Valve simple, basal part of costal margin of valve with spines. Basal process sclerotized. Juxta two sclerotized lobes with long spines at apex, median plate without spines. Aedeagus with manica strongly spined on one side.

♀. Wing, 13–13·5 mm. Colour and pattern as male. Labial palps with third segment 1/2 length of second, 2 × diameter of eye. Underside of wings browner than male.

GENITALIA ♀ (Pl. 58, figs 354, 355). Anal papillae short. Neck of duct covered with minute spines, with small sclerotized plate near ostium. Bursa with minute spines.

DISCUSSION. This species has a similar fore wing venation to *inops* but is generally smaller and has a prominent black spot on the hind margin of the fore wing which is not present in *inops*. The two species can be separated in the male by the shape of the gnathus, which is long and slender in *pellucida* but short and covered in minute spines in *inops*. The basal process is not hooked in *pellucida* as in *inops* and the manica of the aedeagus of *pellucida* is covered with spines. The female genitalia of *pellucida* and *inops* are very similar but the neck of the duct of *pellucida* is more densely covered with spines than in *inops*. From *E. candida*, *E. pellucida* can be separated by the characters given on page 110. The shape of the basal process of the valves of the males from Tanzania and Gambia is different from the other specimens and this may represent subspeciation.

DISTRIBUTION. Map 39. Gambia; Liberia; Cameroon; Gabon; Tanzania.

MATERIAL EXAMINED.

Holotype ♂, CAMEROON: Efulen (*Weber*), BM slide no. 10372, in CMP.

Paratypes. CAMEROON: 3 ♂, 1 ♀, Efulen, 1917–25 (*Weber*), two ♂ in CMP; 1 ♀, Batanga, xi.1910 (*Good*), in CMP; GABON: 1 ♂, Kangwe.

Material not included in the type-series. GAMBIA: 1 ♂ (no other data); LIBERIA: 1 ♂, Nimba, Grassfield, i.1968 (*Forbes-Watson*); TANZANIA: 1 ♂, Mukuya, Kigoma, xii.1963, in NMK.

THE *DANISTA*-GROUP

This contains the next four species, which are characterized by the fusion towards their base of only two of the radial veins of the fore wing, R_3+R_4. This species-group is rather more heterogeneous than the *inops*-group. It includes the species *E. radiata* and *E. vocata* which have very distinct patterns. Whilst the latter is known only from two specimens and its generic position may be clearer when the female is known, there are more specimens of *radiata* which is much more difficult to place in its correct generic position since it does not show any close affinities with other species. The pattern of *radiata* is unusual, which makes it easily recognized. The species *E. danista* has a similar pattern to *R. werneburgalis* Keferstein from Madagascar, but it lacks the tarsal spines of this species.

KEY TO THE *DANISTA*-GROUP

1		Fore and hind wings mostly white	2
–		Fore and hind wings heavily patterned with brown	3
2	(1)	Fore wing with dark costal margin, rest of wing white with narrow brown transverse fascia	***xystica*** (p. 112)

– Costal margin of fore wing without dark marks, transverse fascia yellowish brown **vocata** (p. 113)

3 (1) Pattern mostly reticulate, brown basal area to fore wing. Antennae ciliate **danista** (p. 112)

– Pattern made up of broad brown fasciae, alternate light and dark brown fasciae along terminal margin. Antennae bipectinate . . . . **radiata** (p. 114)

Epaena danista sp. n.

(Pl. 11, fig. 54; Pl. 36, fig. 198; Pl. 59, figs 356, 357)

♂. Wing, 13·5–17 mm. Vertex white with brown scales over base of antennae. Frons rounded, brown, clypeus white. Antennae ciliate. Proboscis small. Labial palps porrect, third segment 1/3 length of second. Patagia white. Thorax brown. Hind tibia with distal pair of spurs short, 1/2 length of 1st hind tarsal segment, proximal spurs very reduced, some specimens with only one proximal spur visible through scales. Fore wing, pattern as in Pl. 11, fig. 54, brown with white areas. Basal area brown, heavily reticulate in median and subterminal areas. Fringe brown and white alternately. Underside similar. Vein R_3 and R_4 with common stalk. Hind wing, strong brown reticulate pattern with white ground colour. Underside similar. Veins $Sc+R_1$ and Rs approach but do not join.

GENITALIA ♂ (Pl. 36, fig. 198). Uncus simple. Gnathus, thin sclerotized loop, no median projection. Valves simple, lightly sclerotized median basal process. Juxta U-shaped, with prominent, spiny, sclerotized processes at apex of arms of "U". Saccus enlarged. Aedeagus with rows of strong, backward projecting, teeth on manica at apex of aedeagus.

♀. Wing, 17 mm. Colour and pattern as male. Labial palps similar. Antennal cilia shorter.

GENITALIA ♀ (Pl. 59, figs 356, 357). Anal papillae slightly elongate. Duct with short sclerotized portion, remainder of duct and bursa with small spines.

DISCUSSION. The similarity of this species to the Madagascan *R. werneburgalis* has already been mentioned (p. 111). The reduction of the proximal pair of spurs is unusual in the genus but varies considerably in different specimens from almost complete reduction of both proximal spurs to the reduction of only one of them. Colour variation is slight but the single Kenyan specimen is darker than the others. The pattern and reduction of the tibial spurs separate this species from all others in the genus.

DISTRIBUTION. Map 39. Kenya; Rhodesia.

MATERIAL EXAMINED.

Holotype ♂, RHODESIA: Victoria Falls Rd, 38 ml. from Bulawayo, 25–26.iv.1954 (*Janse*), BM slide no. 10477, in TMP.

Paratypes. RHODESIA: 1 ♀, Victoria Falls Camp, 3–4.v.1954 (*Janse*), in TMP; 1 ♂, 1 ♀, data as type; 1 ♀, nr Gwai Bridge, 28–29.iv.1954 (*Janse*), in TMP; 2 ♂, Khami, nr Bulawayo, iv.1957, one ♂ in NMR; 1 ♂, Bulawayo, Matopos, Maleme, 13–15.v.1967 (*Pinhey*), in NMR.

Material not included in the type-series. KENYA: 1 ♂, Msambweni, viii.1967 (*Carcasson*); 1 ♂, Galana, 2 ml. E. of Tsavo Nat. Park, iv.1969 (*Clifton*).

Epaena xystica sp. n.

(Pl. 12, fig. 55; Pl. 36, fig. 199)

♂. Wing, 13 mm. (Head damaged). Vertex brown, frons brown, not projecting beyond eyes.

Antennae broken, probably minutely ciliate. Labial palps with third segment 1/3 length of second, upturned not reaching vertex. Patagia grey. Thorax white, irrorate with grey scales. Hind tibia with outer spur of distal pair less than 1/2 length of inner spur. Fore wing, pattern as in Pl. 12, fig. 55, white with grey-brown costal markings enlarged in basal and median areas. Rest of fore wing white with grey-brown markings. Veins R_3 and R_4 anastomose. Underside, as upperside but markings darker. Hind wing, white with prominent grey-brown transverse fascia made up of two lines. $Sc+R_1$ and Rs free, Rs vestigial at base. Cell of hind wing closed, with faint median vein present in cell. $2A$ in hind wing very small.

GENITALIA ♂ (Pl. 36, fig. 199). Uncus simple. Gnathus a weakly sclerotized loop without median process. Valve simple, basal process small, sclerotized with spiny end. Juxta, two conical lateral lobes with a few spines at apex. Aedeagus broad near basal part with lightly sclerotized band round middle.

♀. Unknown.

DISCUSSION. Although only one slightly damaged specimen of this species is known it is sufficiently distinct from the others in the genus to be described. The lightly sclerotized gnathus without median process differentiates this from *pellucida*, *inops* and *candida*. Externally it is more heavily marked than *pellucida* which it most closely resembles.

DISTRIBUTION. Map 37. Tanzania.

MATERIAL EXAMINED.

Holotype ♂, TANZANIA: Amani (*Pringle*), xii.1962, BM slide no. 10412, in BMNH.

Epaena vocata sp. n.

(Pl. 12, fig. 56; Pl. 36, figs 201, 202)

♂. Wing, 11 mm. Vertex and frons reddish brown. Labial palps short, equal to diameter of eye, third segment 1/2 length of second, porrect. Prothorax brown, meso- and metathorax white. Hind tibia with inner spur of distal pair 1/2 length of outer spur. Fore wing, pattern as in Pl. 12, fig. 56, creamy white with yellowish brown marks on termen and pale patches of yellowish brown in median and basal areas. Underside similar, more yellow-brown scales obscuring the white. Veins R_3 and R_4 anastomose. Hind wing, median yellowish brown fascia. Indistinct subterminal fascia, rest of wing creamy white. Underside paler, $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 36, figs 201, 202). Uncus simple. Gnathus with long median process. Valve simple, broad basal area. Juxta with 2 lateral processes, each with small spiny pad near apex and median plate. Aedeagus with minute spines on vesica.

♀. Wing, 14·5 mm. Labial palps porrect, 2 × diameter of eye. Colour and pattern as male but more suffused with yellowish brown. Abdomen missing.

DISCUSSION. This species is only known from two specimens of which the female lacks an abdomen. The generic placing of this species is uncertain. Externally *E. vocata* resembles a small specimen of *N. fuscibasalis* Hampson but the male genitalia are distinct and *fuscibasalis* is without the fusion of the fore wing veins found in *vocata*. Similarly *N. fulvipicta* Hampson has certain similarities in the colour and pattern to *vocata* but that too lacks the fusion of the radial veins of the fore wing.

DISTRIBUTION. Map 38. Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♂, DEMOCRATIC REPUBLIC OF THE CONGO: Stan à Coq [between Stanley-

ville and Coquilhatville along the River Congo], xi.1921 (*Verlaine*), BM slide no. 9939, in MRAC.

Paratype. DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♀, Opala, Lomami R., Prov. Orientale, iii.1959 (*Carcasson*).

Epaena radiata (Warren) **comb. n.**

(Pl. 2, T; Pl. 36, fig. 200; Pl. 59, figs 358, 359)

Beguma radiata Warren, 1908 : 328.
Beguma radiata Warren; Dalle Torre, 1914 : 39.
Beguma radiata Warren; Gaede, 1917 : 358.
Beguma radiata Warren; Gaede, 1929 : 498.

♂. Wing, 12·5–15·5 mm. Vertex brown, frons rounded, produced between eyes. Antennae bipectinate. Labial palps short, slightly less than diameter of eye, third segment 1/3 length of second. Thorax dark brown. Hind tibia with proximal pair of spurs short, distal pair with outer spur slightly shorter than inner spur, longest spur less than 1/2 length of 1st hind tarsal segment. Tarsi mostly without spines, some spines on last tarsal segment on hind leg. Fore wing, pattern as in Pl. 2, T, dark chocolate-brown with lighter and darker transverse fasciae. Frenulum single. Underside paler. Vein R_3 and R_4 shortly stalked. $2A$ reduced to short stalk off $1A$. Hind wing, pattern as fore wing, $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 36, fig. 200). Uncus broad. Gnathus a sclerotized loop without median process. Valve small, narrowing in apical third. Juxta lightly sclerotized. Basal process of valve a broad plate, lightly sclerotized. Aedeagus with few minute spines on vesica.

♀. Wing, 16 mm. Paler coloured than male, pattern similar. Labial palps $1–1\frac{1}{2}\times$ diameter of eye. Frenulum with 4–5 bristles.

GENITALIA ♀ (Pl. 59, figs 358, 359). Anal papillae short. Ostium broad, first part of duct looped, remainder broad, no signum.

DISCUSSION. The pattern of this species immediately separates it from all other African Thyrididae. It varies in intensity of colour but there seems to be little variation in pattern. This species also has a number of morphological peculiarities. The position of this species within the genus *Epaena* is uncertain and it may need a separate genus. There may be some related Indo-Australian species but the wing pattern of *radiata* is unique in the family. With the morphological differences, it is not possible to suggest which species are most closely allied to *radiata* but it fits broadly into the generic concept of *Epaena* given on page 106.

DISTRIBUTION. Map 40. Guinea; Liberia; Ivory Coast; Ghana; Nigeria; Gabon; Democratic Republic of the Congo; Uganda; Sudan.

MATERIAL EXAMINED.

Holotype ♂, DEMOCRATIC REPUBLIC OF THE CONGO; Luebo, Kassai R. (*Landbeck*), BM slide no. 9612, in BMNH.

GUINEA: 1 ♂, Soundedou, nr Macenta, 1600 ft (*Collenette*), v.1926, at light; LIBERIA: 1 ♂, Harbel, Marshall Terr., 14.v.1956 (*Fox*), in CMP; GHANA: 1 ♂, Bibianaha, 70 miles NW. of Dimkwa, 700 ft (*Spurrell*); IVORY COAST: 1 ♂, 1 ♀, Bingerville (*Melou*), vi.1915; 1 ♂, 1 ♀, Forêt du Banco, ix.1963 (*Piart & Griveaud*), in MNHN; 1 ♀ (Oberthur coll.); NIGERIA: 1 ♂, Ibadan, Jericho, 3.iv. 1959, at light; 2 ♂, Ibadan (*Bowden*); 1 ♂, Lagos (*Strachan*); GABON: 1 ♂, Belinga (*Grasse*), Miss. Biol. Gabon, in MNHN; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Ifuta, x.1921; 1 ♂,

Stan à Coq [between Stanleyville and Coquilhatville], xi.1921 (*Verlaine*); UGANDA: 3 ♂, Bwamba, ii–iii.1957 (*Carcasson*), two ♂ in NMK; SUDAN: 1 ♂, Tambura, xii.1922 (*Janson*).

PYRALIDOXA Meyrick

Pyralidoxa Meyrick, 1934 : 538. Type-species, *Pyralidoxa stratifica* Meyrick, by monotypy.
Pyralidoxa Meyrick; Whalley, 1964a : 124.

I am uncertain of the position of this genus. On the basis of some of the morphological features I place it in an intermediate position between the genera *Epaena* and *Kuja*. However, the presence of similar modifications is no proof of relationship between the genera and some of the characters, particularly the "winged" uncus, are those which seem to have appeared independently in several unrelated groups. In the absence of evidence to the contrary I am associating morphologically similar groups, while emphasizing that this is not necessarily a phylogenetic relationship.

The two species in this genus are known only from a few specimens from central Africa. Further studies on the life-history are needed to confirm their specific identity and that they are not seasonal forms of one species. Both species occur in the same locality and the genitalia differences are similar to those found in the genus *Plagodis* Hübner (Lep., Geometridae) where the male genitalia were shown to be seasonally distinct (Rupert, 1949; Munroe, 1959).

GENERIC DESCRIPTION. Labial palps 3-segmented. Eyes without interfacetal hairs. Antennae minutely ciliate. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Tarsi without spines. Fore wing usually with $R_3+R_4+R_5$. Male genitalia with lateral process on uncus and prominent median process on valve.

BIOLOGY. No information.

KEY TO THE AFRICAN SPECIES OF *PYRALIDOXA*

1	Male genitalia with single process on valve	**stratifica** (p. 115)
–	Male genitalia with double process on valve	**elaphropa** (p. 116)

Pyralidoxa stratifica Meyrick
(Pl. 10, fig. 48; Pl. 37, fig. 203)

Pyralidoxa stratifica Meyrick, 1934 : 539.
Pyralidoxa stratifica Meyrick; Whalley, 1964a : 124.

♂. Wing, 12·5–16 mm. Vertex white, base of antennal sockets with darker scales. Frons white, rounded. Labial palps upturned, not reaching vertex. Third segment short, 1/4 length of second segment. Thorax white. Patagia brown. Hind tibia with proximal pair of spurs short, distal pair with outer spur 2 × length of inner spur. Outer spur less than 1/2 length of 1st hind tarsal segment. Fore wing, pattern as in Pl. 10, fig. 48, translucent white with brown costal margin and brown transverse lines. Vein R_5 usually off common stem of R_3+R_4. Underside as upper, paler. Hind wing with $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 37, fig. 203). Uncus with 2 lateral processes near base. Gnathus a simple sclerotized loop, no process in mid-line. Basal part of costa of valve produced into blunt process on either side. Juxta lightly sclerotized. Y-shaped with apex of lateral processes turned

in slightly. Valve with prominent median process. Aedeagus without cornuti, vesica spiny.
♀. Wing, 19 mm. Pattern and colour as male.
GENITALIA ♀ (not figured). Similar to *elaphropa*, Pl. 59, fig. 360, but ostium more sclerotized. Bursa spiny, with two, clearly marked, spiny patches forming signa, one patch one each side of centre of bursa.

DISCUSSION. Considerable variation in the origin of R_5 in the fore wing of this species was found. In one specimen R_5 was absent on one side and in other specimens R_5 was free from R_3+R_4. Generally the subterminal fascia of two lines and the median fascia, made up in the same way, distinguishes this species from the other white African Thyrididae. The genitalia are quite distinct from all the species in other genera. From *P. elaphropa* it can be distinguished by its larger size and by differences in the male genitalia. The affinities of *P. stratifica* are not clear, it is intermediate between species like *K. gemmata* where the development of the uncus is similar and *Epaena inops* where the venation and pattern are similar.

DISTRIBUTION. Map 60. Democratic Republic of the Congo; Tanzania; Malawi.

MATERIAL EXAMINED.

Holotype ♂, DEMOCRATIC REPUBLIC OF THE CONGO: Elisabethville, 27.iii.1933 (*Seydel*), BM slide no. 9515, in MRAC.

DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Lumbumbashi, xii (*Seydel*), in MRAC; 1 ♂, Elisabethville, Lumbumbashi, xi.1926 (*Seydel*), in MRAC; 1 ♀, Elisabethville (*Seydel*), ii.1933; 1 ♀, Elisabethville, xii.1928 (*Seydel*), in MRAC; 1 ♂, Elisabethville, x.1933 (*Seydel*), in MRAC; 2 ♂, Elisabethville, iii.1935 (*Seydel*); 1 ♂, Elisabethville, 16.iii.1937 (*Seydel*), in MRAC; TANZANIA: 2 ♂, Mbinga, Matengo-Hochland, WSW. Songea, 1300–1400 m (*Zerney*), ii.1936, 1 ♂ in NHV; MALAWI: 1 ♀, Mkuwadzi Forest, Nkata Bay, v.1966, in NMR.

Pyralidoxa elaphropa (Meyrick) **comb. n.**

(Pl. 10, fig. 47; Pl. 37, fig. 204; Pl. 59, figs 360, 361)

Hypolamprus elaphropa Meyrick, 1936 : 26.

♂. Wing, 10·5–11 mm. Vertex white with brown scales. Frons rounded, white. Labial palps with third segment 1/4 length of second, upturned, not reaching vertex. Thorax and patagia white. Legs white with brown stripes. Hind tibia with outer spur of distal pair 1/2 length of inner spur. Fore wing, pattern as in Pl. 10, fig. 47, white with grey-brown reticulations. Costal margin grey-brown, prominent ladder-like fasciae in subterminal and median position. Underside similar, Vein R_5 off common stalk of R_3+R_4. Hind wing similar, ladder-like fasciae prominent subterminally and medially. $Sc+R_1$ and Rs approach but do not join
GENITALIA ♂ (Pl 37, fig. 204). Uncus broadly expanded. Gnathus a sclerotized loop without medial process. Strongly sclerotized median process on valve and toothed basal process. Juxta small, apex of lateral arms Y-shaped. Aedeagus with cornuti, vesica minutely spined.
♀. Wing, 11·5 mm. Labial palps with third segment 1/3 length of second segment, otherwise similar to male.
GENITALIA ♀ (Pl. 59, figs 360, 361). Strongly sclerotized V-shaped plate over ostium. Duct minutely spined. Bursa spined.

DISCUSSION. This species is similar to *P. stratifica* and can be distinguished by

its smaller size and by the genitalia. The possible relationship of these two species is discussed on page 115.

DISTRIBUTION. Map 60. Democratic Republic of the Congo; Zambia.

MATERIAL EXAMINED.

LECTOTYPE ♂, here designated, DEMOCRATIC REPUBLIC OF THE CONGO: Elisabethville, 20.ii.1934 (*Seydel*), BM slide no. 10821, in MRAC.

DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Elisabethville, ii.1930 (*Seydel*), in TMP; 1 ♀, Elisabethville, ii.1934 (*Seydel*) (paralectotype); 2 ♂, Elisabethville, 2.iii. 1935 (*Seydel*), one ♂ in MRAC; 2 ♂, Elisabethville, 22.iii.1935, in MRAC; 1 ♂, Elisabethville, 12.ix.1936 (*Seydel*), in MRAC; 2 ♂, Elisabethville, ii.1938 (*Seydel*), one ♂ in MRAC; ZAMBIA: 2 ♂, 1 ♀, Mwinilunga, Ikalenga, Zambezi Rapids, 24.i.1965, one ♂, one ♀ in NMR.

KUJA gen. n.

Type-species, *Rhodoneura gemmata* Hampson.

This genus, if restricted to two species (*gemmata* and *catenula*) is a very distinct one with characteristic wing shape and male genitalia. However, for the present I have enlarged the concept of the genus to include some other species (the *squamigera*-group, p. 121). This latter group again presents a distinctive unit on external pattern but it also provides a link with the *gemmata*-group in the structures of the male genitalia. While externally the species of the *squamigera*-group are very similar (Pl. 13, figs 61, 63 and 65) the genitalia of the species within the group are very different. The question of the similarity of pattern being a convergent or mimetic state must not be overlooked but with the evidence at present available I am grouping the species in both groups in one genus. The pattern of the *squamigera*-group is also found in species from other regions and further investigation may reveal that they should be treated as belonging to a separate genus. With the differences in genitalia of the males of the *squamigera*-group I prefer to regard the genitalia as a variable character, grouping the species together on other characters. Possibly an examination of the Indo-Australian fauna will show whether this type of variation in the genitalia is intra-generic or whether new genera will have to be erected for species of the *squamigera*-group.

This genus is separated into the *gemmata*- and *squamigera*-groups. The *gemmata*-group, with two species, has a very distinctive wing shape and genitalia. The *squamigera*-group have a distinctive wing pattern but show greater divergence in the shape of the male genitalia.

The genus *Kuja* does not show close affinities with any other African genus. In some respects it is similar to the heterogeneous genus, *Sijua*, but this genus lacks the black and silver scaling under the fore wing so characteristic of species of *Kuja*. The females of these genera show differences in the duct of the bursa, these have small sclerotized plates on them in *Sijua* but they are smooth in *Kuja*.

Most of the species of *Kuja* are West African, the exceptions are *K. hamatipex* which is known only from the holotype from the Somali Republic, *K. squamigera* which is Southern African in distribution and *K. carcassoni* from East Africa. The

genus has not been recognized outside Africa south of Sahara and does not occur in Madagascar.

Generic description. Labial palps 3-segmented. Antennae shortly ciliate. Eyes without interfacetal hairs. Proboscis present. Epiphysis on fore tibia. Hind tibia with two pairs of spurs, proximal spur often slightly clavate. Tarsi without spines. Black and silver scales forming patches under fore wing. Radial veins from cell (except *K. kibala*). Uncus of male simple or modified. No signum in bursa in female.

Biology. No information. Some evidence from localities suggest that the species are primarily forest-dwelling.

The two species-groups are separated on wing shape and genitalia. The *GEMMATA*-group: Apex of fore wing pointed. Terminal margin sinuous. Uncus with broad lateral expansions.

The *SQUAMIGERA*-group: Apex of fore wing rounded. Uncus usually simple, if slightly expanded laterally, termen never sinuous.

The two species-groups are included together in the following key.

Key to the African Species of *KUJA*

1		Terminal margin of fore wing angular, strongly incised below apex. General colour reddish brown or brown	2
–		Terminal margin slightly angular, very slightly incised below apex. Pale yellow-brown	3
2	(1)	Dark reddish brown. Male genitalia with short median process on gnathus	***gemmata*** (p. 119)
–		Brown. Male genitalia with long median process on gnathus .	***catenula*** (p. 119)
3	(1)	Fore wing with some radial veins joined	4
–		Fore wing with all radials, R_2 to R_5, from cell	5
4	(3)	Fore wing with R_2+R_3	***majuscula*** (p. 126)
–		Fore wing with R_3+R_4	***kibala*** (p. 125)
5	(3)	Male genitalia with hairy, square-ended sacculus. Gnathus with two small lateral processes	***carcassoni*** (p. 126)
–		Genitalia not as above	6
6	(5)	Subapical line of fore wing straight (Pl. 14, fig. 68). Female with broad anal papillae (Pl. 60, fig. 371). Male genitalia as in Pl. 38, fig. 211	***effrenata*** (p. 124)
–		Subapical line of fore wing usually curved. Genitalia not as above. . .	7
7	(6)	Subapical line strongly recurved from apex (Pl. 13, fig. 61)	9
–		Subapical line not strongly curved (Pl. 13, fig. 63)	8
8	(7)	Wing over 14 mm. Genitalia as in Pl. 37, fig. 207 . .	***squamigera*** (p. 121)
–		Wing under 13·5 mm. Genitalia not as above . . .	***hamatipex*** (p. 124)
9	(7)	Reddish brown median and basal areas, subapical line often incomplete, broader at terminal margin. Genitalia as in Pl. 38, fig. 209 . .	***fractifascia*** (p. 123)
–		Grey-brown median and basal areas. Subapical line narrowing at terminal margin. Genitalia as in Pl. 37, fig. 208	***obliquifascia*** (p. 122)

The *GEMMATA*-Group

This contains the two closely related species, *gemmata* and *catenula*. Externally they are very similar but *catenula* tends to be a lighter coloured species than *gemmata* and there are differences in the genitalia. This group is separated from the *squamigera*-group by the shape of the termen of the fore wing and the presence of the strong lateral processes on the uncus of the male.

Kuja gemmata (Hampson) **comb. n.**

(Pl. 12, figs 59, 60; Pl. 37, fig. 205; Pl. 60, figs 364, 365)

Rhodoneura gemmata Hampson, 1906 : 119.
Rhodoneura gemmata Hampson; Dalle Torre, 1914 : 23.
Rhodoneura gemmata Hampson; Gaede, 1917 : 364.
Rhodoneura gemmata Hampson; Gaede, 1929 : 491.

♂. Wing, 12·5–19·5 mm. Vertex dark brown, irrorate with yellow scales. Frons brown, not swollen. Labial palps with third segment 1/3 length of second, upturned, reaching vertex. Length of palp approximately equal to diameter of eye. Thorax reddish brown. Hind tibia with inner spur of proximal pair slender with clavate end, outer spur of distal pair slightly more than 1/2 length of inner spur, inner spur of distal pair 1/2 length of 1st hind tarsal segment. Fore wing, pattern as in Pl. 12, fig. 59, reddish brown with lighter fringes, light reticulations and transverse pattern. Underside paler, five or six patches of black scales surrounded by yellow scales in cell (Pl. 12, fig. 60), apex of cell with scattered yellow scales. Hind wing, colour and pattern as fore wing but no black and yellow spots on underside. $Sc+R_1$ and Rs approaching, but not joining. Base of Rs and M_1 obsolete, M_1 from cell.

GENITALIA ♂ (Pl. 37, fig. 205). Uncus with strong lateral "wings". Aedeagus with cornuti.

♀. Wing, 17–25 mm. Colour and pattern as male. Labial palps with third segment 1/2 length of second. Hind tibia with proximal spurs as large as distal pair, not slender and clavate as in male.

GENITALIA ♀ (Pl. 60, figs 364, 365). Anal papillae broad. Ostium and part of duct strongly sclerotized.

DISCUSSION. This species is very closely allied to *K. catenula* from which it can be separated by the much darker brown colour (almost mahogany colour), by the shape of the lateral process on the uncus and the length of the gnathus. In the female, the duct of *catenula* is less heavily sclerotized in the first part near the ostium than in *gemmata*.

DISTRIBUTION. Map 56. Senegal; Guinea; Liberia; Sierra Leone; Ivory Coast; Nigeria; Cameroon; Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♂, NIGERIA: Old Calabar (*Crompton*), BM slide no. 9047, in BMNH.

SENEGAL: 1 ♂, Sedhiou, 25–27.iii.1917 (*Castell*); GUINEA: 1 ♂, Beyla (*Mrázek*), in MMB; LIBERIA: 1 ♀, Harbel, Marshall Terr., 24.vii.1955 (*Fox*), in CMP; 1 ♂, Nimba, Grassfield, vii–viii.1967 (*Forbes-Watson*), in NMK; IVORY COAST: 4 ♂, 1 ♀, Bingerville, 1915 (*Melou*); NIGERIA: 6 ♂, 1 ♀, Warri (*Roth*), 1897; 1 ♂, nr Lagos (*Lowe*), i.1920; 1 ♂ (no other data); 1 ♂, Anambara Creek, Niger; 1 ♂, Degama, Niger (*Ansorge*); SIERRA LEONE: 1 ♀ (no other data); CAMEROON: 11 ♂, 1 ♀, Efulen (*Weber*), ten ♂, one ♀ in CMP; 1 ♀, Bitje, Ja River, 2000 ft, dry season, vi–vii.1909 (*Bates*); DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Kasai, Mashala, iv.1959 (*Carcasson*), in NMK; 2 ♂, Sankuru, Katako-Djeka, ix.1952 (*Fontaine*), in MRAC; 3 ♂, 1 ♀, no locality, in CMP (probably Cameroon).

Kuja catenula (Pagenstecher) **comb. n.**

(Pl. 12, fig. 57, 58; Pl. 37, fig. 206; Pl. 60, fig. 366)

Siculodes catenula Pagenstecher, 1892 : 73.
Rhodoneura catenula (Pagenstecher) Hampson, 1897 : 619.

Rhodoneura catenula (Pagenstecher); Dalle Torre, 1914 : 21.
Rhodoneura catenula (Pagenstecher); Gaede, 1917 : 367.
Rhodoneura catenula (Pagenstecher); Gaede, 1929 : 491.

♂. Wing, 16·5–20 mm. Vertex brown, irrorate with light brown. Frons similar, rounded. Labial palps with third segment 1/3 length of second, upturned, reaching vertex. Length of palp approximately equal to diameter of eye. Thorax brown. Hind tibia with inner spur of proximal pair very slender with clavate end, outer spur of distal pair slightly more than 1/2 length of inner spur; inner spur of distal pair 1/2 length of first hind tarsal segment. Fore wing, pattern as in Pl. 12, fig. 57, grey-brown with darker brown median and basal areas. Prominent reticulations. Underside paler, five or six patches of black scales (Pl. 12, fig. 58) surrounded by yellow scales in cell. Apex of cell with scattered yellow scales. Hind wing, colour and pattern as fore wing but no black and yellow spots on underside. $Sc+R_1$ approaches Rs but does not join it.

GENITALIA ♂ (Pl. 37, fig. 206). Aedeagus with shorter cornuti than *gemmata*.

♀. Wing, 22–23 mm. Colour and pattern as male. Labial palps with third segment 1/2 length of second. Hind tibia with proximal and distal pair of spurs almost equal in size, proximal pair not slender as in male.

GENITALIA ♀ (Pl. 60, fig. 366). Anal papillae broad, no signum.

DISCUSSION. This species is closely allied to *gemmata*, the grey-brown colour, rather than red-brown, separating this species from *gemmata*. There are also differences in the length of the gnathus and in the shape of the processes on the uncus. In a series there is little difficulty in distinguishing *catenula* from *gemmata*. However, until more is known of the biology of these two species there is an element of doubt about their relationship. Gaede (1929) considered *gemmata* might be a form of *catenula* but no intermediates have been found in the series examined. In the original description of *catenula* Pagenstecher gives "Natal" as the type-locality and says that the type-specimen is a female. The specimen in the Zoological Museum, Berlin, labelled "origin" and with Pagenstecher's labels is a male from the Cameroon. No recent specimens of this species having been found in South Africa, it seems possible that the locality "Natal" given in the original description was an error. I am therefore regarding Cameroon as the type-locality for this species.

DISTRIBUTION. Map 57. Sierra Leone; Liberia; Ghana; Nigeria; Fernando Po; Cameroon; Rio Muni; Gabon; Democratic Republic of the Congo; Uganda; Angola.

MATERIAL EXAMINED.

Holotype ♂ (not ♀), CAMEROON (not Natal): Kamerun, *Siculodes catenula* Pag., origin, coll. Staudinger, BM slide no. 9652, in ZMB.

SIERRA LEONE: 2 ♂, Njala, 1932 (*Hargreaves*); LIBERIA: 1 ♂, Harbel, Marshall Terr. (*Fox*), 1956, in CMP; GHANA: 1 ♂, Coomassie [Kumasi] (Whiteside); 1 ♂, Sekondi; NIGERIA: 1 ♂, Ilesha (*Humphrey*); 1 ♂, Warri, Niger (*Roth*), ix.1897; FERNANDO PO :1 ♂ (*Cooper*); CAMEROON: 11 ♂, 1 ♀, Efulen (*Weber*); 1913–23, nine ♂, one ♀ in CMP; RIO MUNI: 2 ♂, Benito, ii.1891, ix.1896, in CMP; GABON: 1 ♂, Kangwe, in CMP; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, W. Kivu, Katanga, 5000–7000 ft, iv.1924, highland forest, beginning of wet season (*Barns*); 1 ♀, Uele, Paulis, ix.1959 (*Fontaine*), in MRAC; UGANDA: 1 ♂, Sango Bay, Malabigambo Forest, ii.1968 (*Archer*); ANGOLA: 1 ♂, Pungo Andongo (*Homeyer*); 1 ♂, Quirimbo, 75 km E. of P. Amboim, 300 m, v.1934 (*Jordan*); 5 ♂, no locality, in CMP (probably Cameroon).

The *SQUAMIGERA*-Group

This group includes eight species. The first four species are very similar in pattern but distinct in genitalia. *K. squamigera* has a slightly "winged" uncus reminiscent of the species in the *gemmata*-group. External morphology and pattern are similar in the *squamigera*-group but the genitalia are very distinct. *K. kibala* and *K. majuscula* have a slightly different fore wing venation from the other species in the group.

The *squamigera*-group is separated from the *gemmata*-group mainly by the very distinctive wing pattern and the rounded (not angular) termen.

Kuja squamigera (Pagenstecher) **comb. n.**

(Pl. 13, figs 63, 64; Pl. 37, fig. 207; Pl. 60, figs 367, 368)

Siculodes squamigera Pagenstecher, 1892 : 72.
Pharambara rostrifera Warren, 1898a : 6, **syn. n.**
Rhodoneura squamigera (Pagenstecher) Hampson, 1897 : 622.
Rhodoneura rostrifera (Warren) Dalle Torre, 1914 : 32.
Rhodoneura squamigera (Pagenstecher); Gaede, 1917 : 365.
Rhodoneura rostrifera (Warren); Gaede, 1917 : 364.
Rhodoneura squamigera (Pagenstecher); Gaede, 1929 : 493.
Rhodoneura rostrifera (Warren); Gaede, 1929 : 493.

♂. Wing, 15–18 mm. Vertex brown, frons rounded, irrorate with white. Labial palps with third segment 1/4 length of second, upturned, not reaching vertex. Thorax brown. Hind tibia with proximal pair of spurs slender, inner spur long, slightly clavate, 4 × length of outer spur. Distal pair of spurs with outer spur slightly more than 1/2 length of inner; inner spur 2/3 length of 1st hind tarsal segment. Fore wing, pattern as in Pl. 13, fig. 63, yellow-brown with darker grey-brown markings. $1A$ and $2A$ anastomose near base to form single vein to wing margin. Underside, darker than upper with prominent patch of iridescent black and white scales near apex of cell (Pl. 13, fig. 64). Hind wing, $Sc+R_1$ and Rs free. Colour as fore wing, small patches of black scales in basal area. Median fascia with orange-yellow and black scales. Underside darker than upper, lacking iridescent scales of fore wing.

Genitalia ♂ (Pl. 37, fig. 207). Uncus thickened with prominent dorsal projection. Gnathus a lightly sclerotized loop slightly thickened in middle. Valves with enlarged sacculus and sclerotized median part. Juxta 3-lobed, "W"-shaped, strongly spined. Aedeagus thin, broader near base, no cornuti.

♀. Wing, 18 mm. Colour and pattern as male, including scale patch under fore wing. Labial palps with third segment nearly 1/2 length of second. Hind tibia with outer spur of proximal pair 1/4 length of inner spur. Inner long spur not clavate as in male.

Genitalia ♀ (Pl. 60, figs 367, 368). Anal papillae short. Ostium and first part of duct sclerotized, bursa without signum. Opening of duct on VIIIth segment (contrast *obliquifascia* where opening is intersegmental between VII and VIII).

Discussion. Externally this species is similar to both *obliquifascia* and *fractifascia*, but the amount of curvature of the subapical line can be used to separate these species. In *squamigera* the arc made by this line is sharp and deep, in *obliquifascia* it tends to be rather shallow and in *fractifascia* this arc is incomplete. In the genitalia considerable differences occur between these species which suggests that the group is not a natural one but the other morphological features are similar. The diverse forms of the genitalia in these species may indicate that the fore wing

pattern similarity is a convergent resemblance but for the present the group is one of external morphological similarity.

DISTRIBUTION. Map 58. Zambia; Mozambique; South Africa.

MATERIAL EXAMINED.

Holotype ♂ (*squamigera*), SOUTH AFRICA: Natal, Verulam, BM slide no. 9626, in ZMB. Holotype ♂ (*rostrifera*), SOUTH AFRICA: Northdene, Natal, BM slide no. 9591, in BMNH.

ZAMBIA: 1 ♂, Gimson, 1908; MOZAMBIQUE: 1 ♂, Changalane, xi.1950 (*Ferreira*), in TMP; SOUTH AFRICA: 1 ♀, Natal, Durban, iii.1907 (*Leigh*); 1 ♀, Durban, iii.1909 (*Leigh*), in TMP; 1 ♂, Durban (*Clarke*); 3 ♂, Natal (*Spiller*); 1 ♂, Lower Umkomass, Natal (*Leigh*), iv.1905; 1 ♂, Mfongosi, Zulul., ii.1912 (*Jones*), in CT; 1 ♂, Park Rynnie, 41 ml. from Durban (*Leigh*), iv.1905; 2 ♂, Natal, Verulam (*Spiller*); 2 ♂, Congella, Durban (*Leigh*), xi–xii.1904; 2 ♀, Victoria District (*Gooch*), one ♀ in CT; 1 ♂, 1 ♀, Natal, Northdene; 1 ♂, Pretorius kop, iii.1952 (*Janse & Vari*), in TMP; 1 ♂, Port St John, xi.1956 (*van Son & Martin*), in TMP; 1 ♂, Port St John, ii.1955 (*Janse*), in TMP; 1 ♀, Jozini Dam, Lebombo Mts, Natal, i.1965 (*Vari*), in TMP; 1 ♂, Midw. L. Trich., Wyl. Prt., i.1925 (*Janse*), in TMP; 1 ♀, Zululand (*Reynolds*); 1 ♂ (no other data).

Kuja obliquifascia (Warren) **comb. n.**

(Pl. 13, figs 61, 62; Pl. 37, fig. 208; Pl. 60, figs 369, 370)

Pharambara obliquifascia Warren, 1908 : 343.
Pharambara obliquifascia Warren; Dalle Torre, 1914 : 30.
Rhodoneura obliquifascia (Warren) Gaede, 1917 : 365.
Rhodoneura obliquifascia (Warren); Gaede, 1929 : 493.

♂. Wing, 13–17 mm. Vertex brown, frons flattened between eyes. Labial palps with third segment 1/2 length of second, upturned, just reaching vertex. Thorax brown. Hind tibia with proximal pair slender, longest one slightly clavate, distal pair with outer spur 2/3 length of inner spur, hind tibia with long scent scales. Fore wing, pattern as in Pl. 13, fig. 61, yellow-grey with brown reticulations. Median brown fascia curved to terminal margin. Underside darker, prominent black and silver scales in cell and along base of some fore wing veins (Pl. 13, fig. 62). Hind wing, colour as fore wing, underside darker, no iridescent scales as fore wing. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 37, fig. 208). Uncus simple. Gnathus with two weakly sclerotized lateral arms, barely joining in mid-line. Valve with sacculus enlarged and prominent median spine. Basal process on valve broadly sclerotized. Juxta consisting of two strongly sclerotized pointed "U"-shaped processes. Aedeagus with minute spines on vesica and strongly spined manica. Group of spines dorsal to transtilla.

♀. Wing, 17–19 mm. Colour and pattern as male. Labial palps with third segment 1/2 length of second, upturned, not reaching vertex.

GENITALIA ♀ (Pl. 60, figs 369, 370). Anal papillae short. Ostium broad and sclerotized covered with minute spines. Duct opening intersegmentally between VIIth and VIIIth segments.

DISCUSSION. This species is similar externally to *squamigera* but the genitalia are quite distinct. The species varies in colour, in some specimens the colour is very pale straw yellow.

DISTRIBUTION. Map 58. Gabon; Rio Muni; Cameroon; Rwanda; Uganda; Kenya; Angola.

MATERIAL EXAMINED.

Holotype ♂, ANGOLA: Pungo Andongo, iv.1875 (*Homeyer*), BM slide no. 9592, in BMNH.

CAMEROON: 1 ♂, Bitje, Ja River, i–iii.1907, 2000 ft, 1914, dry season (*Bates*); 1 ♂, Bitje, iv–v.1912, wet season; 20 ♂, 1 ♀, Efulen (*Weber*), 1912–28, nineteen ♂, one ♀ in CMP; 1 ♂, Efulen (*Good*), in CMP; 1 ♂, Batouri, District, Lat. 3° 45′ N, Long. 13° 45′ E, iv.1955 (*Merfield*); 1 ♂, Sangmelima (*Good*), ii.1933, in CMP; GABON: 1 ♂, Kangwe, in CMP; RIO MUNI: 3 ♂, Benito, i–iii.1891, two ♂, in CMP; RWANDA: 2 ♂, Kisenyi, iv.1957 (*Fontaine*), in MRAC; UGANDA: 6 ♂, Katera, Sango Bay, Masaka, x.1960 (*Carcasson*), one ♂ in NMK; 1 ♂, Kigezi, Kayonza, v.1957; 2 ♂, Kigezi Distr., Kawungu, Impenetrable Forest, 4500 ft, v.1952 (*Burgess*); 3 ♂, Kalinzu Forest, Ankole, xi.1961 (*Carcasson*), one ♂ in NMK, one ♂ in NMR; 1 ♂, Bwamba, vi.1956 (*Carcasson*), in NMK; 1 ♀, Jinja, Mabira Forest, x.1962 (*Carcasson*), in NMK; KENYA: 1 ♂, Kakamega, xii.1965 (*Carcasson*) in NMK; 2 ♂, Mt Elgon (*Jackson*), ix.1951, one ♂ in NMK; ANGOLA: 3 ♂, data as type; 1 ♂, Fazenda, Congulu, Amboim Distr., 7000–8000 m, iv.1934 (*Jordan*); 13 ♂, 1 ♀, no locality in CMP (probably Cameroon).

Kuja fractifascia (Warren) **comb. n.**

(Pl. 13, figs 65, 66; Pl. 38, fig. 209)

Pharambara fractifascia Warren, 1908 : 342.
Rhodoneura fractifascia (Warren) Dalle Torre, 1914 : 23.
Rhodoneura fractifascia (Warren); Gaede, 1917 : 365.
Rhodoneura fractifascia (Warren); Gaede, 1929 : 493.

♂. Wing, 13–16·5 mm. Vertex and frons brown. Labial palps with third segment 1/2 length of second, upturned, reaching vertex. Thorax brown. Hind tibia with proximal pair of spurs slender, inner clavate; distal pair with outer spur slightly more than 1/2 length of inner spur. Fore wing, pattern as in Pl. 13, fig. 65, brown with pale brownish white ground colour. Underside, black and white scales in patches in cell (Pl. 13, fig. 66). Hind wing, colour as fore wing. Median and sub-apical fascia distinct, underside paler than upper. $Sc+R_1$ and *Rs* approach but do not join.

GENITALIA ♂ (Pl. 38, fig. 209). Uncus simple. Gnathus a thin sclerotized loop with small, weakly sclerotized median process. Valve simple, large basal process extended in long sclerotized half way along valve. Juxta, two pointed lateral lobes, with spines along inner side, two broad lobes at 90° to lateral lobes. Aedeagus with prominent cornuti.

♀. Unknown.

DISCUSSION. The fore wing pattern with a completely brown basal and median area and the incomplete brown "hook" of the subapical line separate this species from *obliquifascia* and *squamigera*. The genitalia, with the long process on the valve are quite distinct.

DISTRIBUTION. Map 59. Sierra Leone; Nigeria; Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♂, NIGERIA: Ogruga River, Niger, BM slide no. 9589, in BMNH.

SIERRA LEONE: 1 ♂, Bo (*Revell*), vii.1967; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Opala, Lomami R., Prov. Orientale, iii.1959 (*Carcasson*); 1 ♂, Loile River, Ikela, Equateur, iv.1959 (*Carcasson*); 1 ♂, Upper Oso River, NW. Kivu, 4000 ft, forest with some grass, ii.1924 (*Barns*), wet season; 1 ♂, Equateur, Flandria, vii.1931 (*Hulstaert*), in MRAC.

Kuja hamatipex (Hampson) **comb. n.**

(Pl. 14, fig. 67; Pl. 38, fig. 210)

Rhodoneura hamatipex Hampson, 1916 : 168.
Rhodoneura hamatipex Hampson; Gaede, 1929 : 493.

♂. Wing, 11·5 mm. Vertex brown. Antennae ciliate with short lamellae. Frons rounded. Labial palps with third segment approximately 1/2 length of second, upturned, not reaching vertex. Thorax brown. (Hind legs missing.) Fore wing, pattern as in Pl. 14, fig. 67, brown with darker brown reticulations and brown subapical loop. Underside, as upper side, prominent black and white scales in cell. Hind wing, colour similar to fore wing. $Sc+R_1$ and *Rs* free.

GENITALIA ♂ (Pl. 38, fig. 210). Uncus simple, Gnathus arms thickened, with a thin sclerotized loop joining mid-line. Valve simple, with median process. Juxta with two lobes, each with raised, sclerotized "keel". Saccus enlarged. Aedeagus with strongly spined vesica.

♀. Unknown.

DISCUSSION. Although externally this species resembles the others in the *squamigera*-group, the genitalia are quite distinct. Since only one specimen is known and there is an element of doubt as to whether the abdomen is the original one, the relationship of this species is uncertain.

DISTRIBUTION. Map 59. Somali Republic.

MATERIAL EXAMINED.

Holotype ♂, SOMALI REPUBLIC: Mandera, 47 m, SW. of Berbera, 3000 ft, open and bush (*Feather*), 30.x.1908, BM slide no. 9590, in BMNH.

Kuja effrenata **sp. n.**

(Pl. 14, fig. 68; Pl. 38, fig. 211; Pl. 60, figs 371, 372)

♂. Wing, 13–13·5 mm. Vertex light brown. Frons rounded, projecting slightly between eyes. Labial palps 2 × diameter of eye, third segment 1/2 length of second, upturned, reaching vertex. Thorax grey-brown. Hind tibia with proximal pair of spurs slender, distal pair thicker, outer spur of distal pair 1/2 length of inner spur. Fore wing, pattern as in Pl. 14, fig. 68, grey-brown with paler areas. Costal margin grey-brown. Underside with prominent patch of black, silver and red-brown scales in cell, with patch of white scales behind cell and some white scales towards apex. Apical part of underside of costa reddish brown. Hind wing, colour and pattern as fore wing, underside without black and silver scales. $Sc+R_1$ and *Rs* approach but do not join.

GENITALIA ♂ (Pl. 38, fig. 211). Uncus simple. Gnathus arms not meeting in middle. Valve simple, basal process sclerotized. Juxta with two lateral lobes and broad sclerotized plate with minute spines. Base of juxta with long hairs. Aedeagus with spiny manica and group of cornuti.

♀. Wing, 18·5 mm. Colour and pattern as male. Labial palps 2-½ × diameter of eye.

GENITALIA ♀ (Pl. 60, figs 371, 372). Anal papillae short, rather rounded. Ostium spiny, broad, duct lightly sclerotized, bursa with minute spines.

DISCUSSION. Externally this species is similar to *K. fractifascia* but the subapical line of *effrenata* is straight and continuous, whereas in *fractifascia* it is usually interrupted and curved. The genitalia of the two species are distinct. *K. effrenata* is placed in the *squamigera*-group on pattern but the genitalia of the males are less modified than the others in the group.

DISTRIBUTION. Map 59. Cameroon; Gabon; Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♂, CAMEROON: Efulen (*Weber*), 24.iii.1923, BM slide no. 10648, in CMP.

Paratypes. CAMEROON: 1 ♂, Efulen (*Weber*), 24.xi.1916, in CMP; 1 ♀, Bitje, Ja River, x., wet season (*Bates*); 1 ♀, Bitje, iv–v.1912, wet season; GABON: 1 ♀, Makokou, 500 m, 8.iii.1962 (*Bernardi*), in MNHN; 1 ♀, Belinga, 600 m, Camp Centrale, 25.xii.1962 (*Demeyer*), in MNHN.

Material not included in the type-series. DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Middle Lowa Valley, nr Walikali, 3000–4000 ft, ii.1924, wet season (*Bates*).

Kuja kibala sp. n.

(Pl. 14, fig. 69; Pl. 38, fig. 212)

♂. Wing, 11–12·5 mm. Vertex white, irrorate with brown. Antennae ciliate. Labial palps with third segment 1/3 length of second, upturned, not reaching vertex. Frons projecting slightly between eyes. Thorax yellowish brown. Hind tibia with proximal pair short, inner spur scarcely showing through scales, distal pair of spurs with outer spur slightly more than 1/2 length of inner spur. Fore wing, pattern as in Pl. 14, fig. 69, sandy brown with grey-brown reticulations. Terminal margin incised below apex. Underside similar, paler, scattered black and white scales in cell. Subapical and median fascia conspicuous on upper and under sides. Veins R_3 and R_4 stalked. Hind wing, colour and pattern as fore wing. $Sc+R_1$ and *Rs* free.

GENITALIA ♂ (Pl. 38, fig. 212). Uncus simple. Gnathus a weakly sclerotized loop. Valve simple. Median basal process well sclerotized. Juxta a broad plate deeply divided in middle with few small spines apically. Aedeagus with small sclerotized plate-like cornutus and spiny vesica.

♀. Unknown.

DISCUSSION. Some variation is present in the colour of the specimens examined, the Kenyan specimen being darker than the Ugandan one. There is also slight variation in the shape of the juxta. The relationships of this species are not clear. Basically it fits into the genus *Kuja* but has certain peculiarities of its own, such as the fusion of R_3 and R_4 for part of their length in the fore wing and the more strongly ciliate antennae. The pattern is fairly typical of the *squamigera*-group. From the other species in the group, *kibala* can be separated by the fusion of the radial veins of the fore wing and the ciliation of the antennae. The relationship between *kibala* and *majuscula* is not clear, they differ in wing venation but otherwise are rather similar.

DISTRIBUTION. Map 59. Uganda; Kenya; Zambia.

MATERIAL EXAMINED.

Holotype ♂, UGANDA: Kibale, viii.1964 (*Dudley*), BM slide no. 10263, in BMNH.

Paratypes. KENYA: 1 ♂, Nairobi, iv.1961 (*Carcasson*), in NMK; 3 ♂, Nairobi, iv.1966 (*Carcasson*); two ♂ in NMK; 1 ♂, Lumbwa, 17.iv.1923 (*Jeffery*); ZAMBIA: 1 ♂, Abercorn, xi.1963 (*Brown*).

***Kuja carcassoni* sp. n.**

(Pl. 14, fig. 70; Pl. 38, fig. 213)

♂. Wing, 9–10 mm. Vertex brown. Antennae shortly ciliate. Labial palps with third segment 1/2 length of second, upturned, not reaching vertex. Thorax yellowish brown. Hind tibia with proximal pairs of spurs long, distinctly clavate. Distal pair of spurs with inner spur 1/3 longer than outer. Fore wing, pattern as in Pl. 14, fig. 70, brown with darker grey-brown reticulations. Terminal margin very slightly incised below apex. Underside similar, paler, with scattered black and silver scales in cell. Median fascia conspicuous in upper and underside of fore wing. Fore wing veins free, R_3 and R_4 approach closely near cell. Hind wing, colour as fore wing but without black scales on underside, median fascia narrower than fore wing.

GENITALIA ♂ (Pl. 38, fig. 213). Gnathus lightly sclerotized with two lateral small processes. Valves simple, rounded, prominent process at apex of sacculus square-ended. Base of sacculus rounded slightly thickened. Juxta, two prominent lateral plates. Saccus slightly elongate. Aedeagus with very strongly spined vesica.

♀. Unknown.

DISCUSSION. This species can be distinguished from most others in the genus by its small size. In the male genitalia the broad, hairy, square-shaped end to the sacculus are characteristic and separate this species from all others in the genus. This species is similar in size to *K. majuscula* but lacks the fusion of radial veins in the fore wing of that species and is more heavily patterned. The subterminal line in the fore wing which is conspicuous in most of the other species in the *squamigera*-group is not so clearly shown by *K. carcassoni*.

DISTRIBUTION. Map 59. Kenya.

MATERIAL EXAMINED.

Holotype ♂, KENYA: Tiwi, Mombasa, Kenya Colony, iv–v.1957 (*Carcasson*), BM slide no. 10607, in BMNH.

Paratypes. KENYA: 1 ♂, Msambweni, Kenya Coast, viii.1967 (*Carcasson*); 1 ♂, Sokoke Forest, Brachestegia, 8 ml S. of Malindi, iv.1969 (*Clifton*), in NMK.

***Kuja majuscula* (Gaede) comb. n.**

(Pl. 23, fig. 123; Pl. 61, fig. 373, 374)

Betousa majuscula Gaede, 1917 : 379.
Betousa minutula majuscula Gaede; Gaede, 1929 : 495.

♀. Wing, 11 mm. Vertex brown, irrorate with white. Antennae minutely ciliate. Proboscis present. Labial palps upturned, not reaching vertex. Fore wing, pattern as in Pl. 23, fig. 123, brown with darker markings. Veins R_2+R_3 stalked. Underside more heavily patterned than upperside, median brown fascia, short fascia subapically from costa to 1/3 along termen. Black and silver scales in cell and scattering of black scales along anterior veins. Hind wing, similar but no black and silver scales on underside.

GENITALIA ♀ (Pl. 61, fig. 373, 374). Anal papillae short, ostium lightly sclerotized. Duct spined. Bursa minutely spined.

♂. Unknown.

Discussion. This species is only known from the holotype. It seems most closely related to *K. kibala* but is less heavily patterned and has different fore wing venation. Until more specimens are found the relationship of this species with the others in the group is not clear. Gaede (1929 : 495) suggested that this species was a subspecies of "*B. minutula*" (=*Striglina minutula* Saal.) and he also suggested that *majuscula* might be near *hamatipex* Hampson. In this latter suggestion he was more nearly correct.

Distribution. Map 57. Tanzania.

Material examined.
Holotype ♀, Tanzania: Tendaguru, Lindi (*Janesch*), BM slide no. 9672, in ZMB.

HYPOLAMPRUS Hampson

Hypolamprus Hampson, [1893] 1892 : 364. Type-species, *Microsca striatalis* Swinhoe, by original designation.
Hypolamprus Hampson; Whalley, 1964a : 121.
[*Hypolamprus* sensu Whalley, 1967 : 36, nec Hampson.]

The five species in this genus are separated into two species-groups on the basis of different antennal structures. The *curvifluus*-group (*curvifluus*, *distrinctus*, *gangaba*) have shortly ciliate antennae, the *janenschi*-group (*janenschi*, *quaesitus*) have monopectinate antennae. *H. curvifluus* and *H. distrinctus* are similarly patterned species, differing externally in size and colour. *H. curvifluus* is widespread in Africa and is one of the few species of Thyrididae (other than those of the genus *Dysodia*) which extend into South Africa. *H. gangaba* is similar to the Indian species, *R. bastialis* on external characters but the genitalia are different. This species has previously been (incorrectly) recorded from Africa. Few specimens of the species in the *janenschi*-group have been examined and the relationship between these species and those in the *curvifluus*-group is not clear. All the species in the genus have the characteristic twin signa in the bursa of the females. This genus is related to *Hapana* Whalley but can be separated from this genus by the origin of the radial veins in the fore wing, these are from the cell in *Hypolamprus* but $R_2 + R_3$ are stalked in *Hapana*.

The genus *Hypolamprus* is known from Africa, the Indo-Pacific region and has one species described from South America. It does not occur in Madagascar, the species described in *Hypolamprus* (Whalley, 1967 : 36) has been transferred to *Cornuterus* Whalley (page 135).

Generic description. Antennae shortly ciliate or monopectinate. Labial palps 3-segmented. Eyes without interfacetal hairs. Proboscis present. Fore wing usually with radial veins from cell. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Tarsi usually without spines. Male with simple uncus and valve. Gnathus usually a sclerotized loop without median process. Female with two thorn-like signa in bursa, first part of duct usually heavily sclerotized.

Biology. No information.

Both species-groups are included in the following key.

KEY TO THE AFRICAN SPECIES OF *HYPOLAMPRUS*

1		White, with strong reticulate pattern. White patch at apex of fore wing, very conspicuous from underside	***gangaba*** (p. 132)
–		Brown species, no white patch at apex of fore wing	2
2	(1)	Antennae monopectinate	3
–		Antennae slightly ciliate	4
3	(2)	Silvery grey median fascia on fore and hind wing. Costa brown, underside with dark brown fascia on fore and hind wing, fringe brown .	***quaesitus*** (p. 131)
–		No silvery grey fascia. Costa black. Fringe black and white. Hind wings without fascia on under or upper side	***janenschi*** (p. 131)
4	(2)	Wing over 10·5 mm. Dark purplish brown, reticulations slightly obscured	***distrinctus*** (p. 130)
–		Wing under 10·5 mm. Pale yellow-brown, conspicuous reticulations	***curvifluus*** (p. 128)

Hypolamprus curvifluus (Warren) **comb. n.**

(Pl. 15, figs 73, 74; Pl. 38, fig. 214; Pl. 61, figs 375–378)

Banisia curviflua Warren, 1898b : 221.
Rhodoneura curviflua (Warren) Dalle Torre, 1914 : 21.
Rhodoneura curviflua (Warren); Gaede, 1917 : 365.
Rhodoneura curviflua (Warren); Gaede, 1929 : 494.

♂. Wing, 9–10 mm. Vertex brown irrorate with white. Labial palps with third segment 1/2 length of second, upturned just reaching vertex. Thorax brown. Hind tibia with outer spur of distal pair slightly more than 1/2 length of inner spur. Fore wing, pattern as in Pl. 15, figs 73, 74, brown with darker reticulations. R_3 and R_4 shortly stalked. Underside paler. Hind wing, colour as fore wing, dark median fascia, margin of wing slightly incised below apex. Underside pale, less heavily marked than underside of fore wing. $Sc+R_1$ and Rs approach but do not join.

GENITALIA ♂ (Pl. 38, fig 214). Uncus simple. Gnathus weakly sclerotized. Valve simple, basal process lightly sclerotized, pointed. Juxta, two rounded lobes with a few hairs. Aedeagus with minute spines in vesica.

♀. Wing, 8–11 mm. Colour and pattern as male. Third segment of labial palps almost equal to second segment.

GENITALIA ♀ (Pl. 61, figs 375–378). Anal papillae short. Ostium frequently V-shaped, duct spiny and sclerotized on first part, fairly broad for remainder. Bursa with two large thorn-like signa on sclerotized plates.

DISCUSSION. This is a very variable species which may be separable into subspecies when more specimens are examined. In the fore wing, R_3 and R_4 are free in some specimens. The colour varies from dark brown in specimens from West Africa to pale brown with a strong reticulate pattern in specimens from South Africa. There is considerable variation in size of the two thorn-like signa in the bursa of the females. Generally the West African specimens have larger and more prominent signa while those of the South African specimens are smaller. These two groups could be distinct subspecies, but a third group of rather small, darker specimens, which occur from Rhodesia to Nigeria, show differing degrees of development of this as well as more sclerotization of the neck of the bursa. None of these differences are constant for any geographic area. A single specimen from Ethiopia which also has the neck of the bursa more sclerotized than the West African ones, has

very reduced signa in the bursa. At present no comparable differences have been found in the male genitalia. Since the presence of the two thorn-like signa in the bursa is very characteristic, this species is at present not divided into subspecies, but is divided into groups of specimens based on the size and shape of the structures in the female bursa. The following groups are obtained:

(*a*) Nigeria, Democratic Republic of the Congo, [Dungu], Kenya. Two long thorn-like spines in bursa.

(*b*) Malawi, S. Africa, Rhodesia, SW. Africa. Shorter spines in bursa, often with more teeth on them.

(*c*) Nigeria, Zambia, Angola, Democratic Republic of the Congo [Elisabethville]. Bursa spines small, duct of bursa more sclerotized than in groups (*a*) and (*b*), specimens smaller in size than those in groups (*a*), (*b*) or (*d*).

(*d*) Ethiopia. Minute pairs of spines on sclerotized plate in bursa, duct sclerotized as in group (*a*).

(*e*) Sudan, Ghana. Thorn-like spines in bursa, duct highly modified.

With the overlap in distribution between these groups, none is a clearly distinct subspecies. More material in each group is needed to establish the relationship of the different groups, and information on the biology, none of which is available at present, would help. In group (*e*) (perhaps even a distinct species) the large sclerotized development round the ostium is the only difference between that specimen and specimens in group (*c*). While the differences between some of these groups are as large as the differences between species in other genera, the general morphology of all specimens at present included in *curvifluus* is very similar.

With the relatively small amount of material available from any one locality, I do not think that naming these groups would serve any useful purpose. *H. curvifluus* can be identified from the characters given and, in particular, is characterized by the signa of the female. Externally *H. curvifluus* is very similar to *H. striatalis* Swinhoe from India, but these two species can be separated by the shape of the basal process on the valve of the male and in the female by the signum.

DISTRIBUTION (all groups). Map 53. Ghana; Nigeria; Democratic Republic of the Congo; Ethiopia; Sudan; Kenya; Tanzania; Burundi; Malawi; Zambia; Rhodesia; Angola; South West Africa; South Africa.

MATERIAL EXAMINED.

Holotype ♀, NIGERIA: Warri (*Roth*), vi.[18]97, BM slide no. 9584, in BMNH.

GHANA: 1 ♀, Kete-Krachi, N. Territories (*Cardinall*); NIGERIA: 1 ♀, Agberi, Niger, vii.1901 (*Ansorge*); 1 ♀, N. Nigeria (*Cator*); DEMOCRATIC REPUBLIC OF THE CONGO: 2 ♂, 1 ♀, Elisabethville, xi.1932–ix.1934 (*Seydel*), one ♂, one ♀ in MRAC; ETHIOPIA: 1 ♀, Dire Daoua, iv.1936 (*Uhlenhuth*); SUDAN: 1 ♀, Roseires-Ingessorna Hills, xi.1939 (*Snow*); 1 ♂, Fung Prov., Kurmuk, iv.1929 (*Disney*); KENYA: 1 ♂, Kitale, iv.1962 (*Dougall*), in NMK; TANZANIA: 1 ♀, Kilossa, i.1922 (*Loveridge*); ZAMBIA: 1 ♀, Nkama, xi.1933 (*Prismall*), in TMP; 1 ♂, Bwana Mkubwa, ix.1929 (*Marley*), in TMP; RHODESIA: 1 ♂, 1 ♀, Bulawayo, ix–x.1953 (*Pinhey*); 1 ♂, Wankie, xi.1961 (*Weir*), in NMR; 1 ♀, Hillside, x.1922 (*Swinburn & Stevenson*), in TMP; 1 ♂, Khami, nr Bulawayo,

xii.1955, in NMR; MALAWI: 3 ♀, Mt Mlanje, iv–xi.1913 (*Neave*); ANGOLA: 1 ♂, Benguella, Caconda, ix.1904 (*Ansorge*); 1 ♀, Ceramba, Bihé, iii.1903 (*Bell*); SOUTH WEST AFRICA: 1 ♂, Abachaus, i.1944 (*Hobohm*), in TMP; SOUTH AFRICA: 2 ♀, Shilouvane, xi.1902 (*Junod*), one ♀, in TMP; 1 ♂, Pretoria, viii.1910 (*Janse*), in TMP; 1 ♀, Natal, Malvern, ix.1897 (*Marshall*); 1 ♀, Shongweni Dam, Natal, ix.1956 (*Dickson*), in TMP; 3 ♀, Pretoria (*van Son*), 8.x.1937, two ♀ in TMP; 2 ♂, Pretoria (*van Son*), ix.1946, one ♂ in TMP; 1 ♂, Zoutpan, Pta., xii.1926 (*van Son*), in TMP; 1 ♂, Rustenburg, ix.1922 (*Impey*), in TMP; 1 ♀, Vryburg, C.C. 1917 (*Brown*); in CT; 1 ♂, Eshowe, xii.1916 (*Marley*), in CT; 1 ♀, Natal, Krantzkop, xi.1917 (*Barnard*), in CT.

Hypolamprus distrinctus sp. n.

(Pl. 15, fig. 77; Pl. 39, fig. 215; Pl. 61, figs 379–381)

♂. Wing, 10·5–11 mm. Vertex brown, frons flattened between eyes. Labial palps with third segment 1/3 length of second, upturned, not reaching vertex. Hind tibia with longest proximal spur almost reaching tip of shortest distal spur, outer spur of distal pair 1/2 length of inner spur. Longest distal spur as long as first hind tarsal segment. Hind tarsi with one or two small spines in median position, last hind tarsal segment with three spines. Fore wing, pattern as in Pl. 15, fig. 77, dark purplish brown with black transverse lines. Basal area paler. Underside brown, darker brown patch over apex of cell. All radial veins from cell. Hind wing, colour and pattern as fore wing, $Sc+R_1$ and Rs approach closely but do not join.

GENITALIA ♂ (Pl. 39, fig. 215). Uncus simple. Gnathus a weakly sclerotized loop. Valves simple, basal process weakly sclerotized, covered with small spines. Membrane near transtilla covered with small spines. Juxta, two lateral lobes with long spines and teeth on inner edge. Aedeagus with few small spines on manica.

♀. Wing, 11–12 mm. Colour and pattern as male. Labial palps longer than male, reaching vertex.

GENITALIA ♀ (Pl. 61, figs 379–381). Anal papillae short. Duct covered with minute spines, first part of duct sclerotized. Two large thorn-like signa in bursa.

DISCUSSION. There is some variation in the colour, two of the Ugandan and the Cameroon specimens are paler than the others but usually this is a very dark brown species. *H. distrinctus* is related to *H. quaesitus* but can be separated from this species by the lack of the silvery grey fascia on the wings, and the wings are broader in *distrinctus* than in *quaesitus*. The wing pattern of *distrinctus* is similar to *curvifluus* but the latter is a smaller and paler coloured species.

DISTRIBUTION. Map 54. Cameroon; Democratic Republic of the Congo; Uganda.

MATERIAL EXAMINED.

Holotype ♂, UGANDA: Kampala, 11.vii.1938 (*Hargreaves*), BM slide no. 10639, in BMNH.

Paratypes. UGANDA: 3 ♂, 3 ♀, data as type; 1 ♀, Kampala (*Hargreaves*), 21.vii. 1938; 1 ♂, Katera, Sango Bay, Masaka, x.1960 (*Carcasson*), in NMK.

Material not included in the type-series. CAMEROON: 1 ♀, Efulen (*Weber*), 21.v.1914, in CMP; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♀, Dungu-Niongora, Druima, v.1912 (*Husmoul*), in MRAC; 1 ♀, Lusambo, 29.xii.1949 (*Fontaine*), in MRAC.

Hypolamprus janenschi (Gaede) **comb. n.**

(Pl. 15, figs 75, 76; Pl. 39, fig. 216; Pl. 62, fig. 382)

Canaea janenschi Gaede, 1917 : 378.
Canaea janenschi Gaede; Gaede, 1929 : 495.

♂. Wing, 11 mm. Vertex dark brown, frons dark brown, rounded, not projecting beyond eyes. Antennae strongly monopectinate. Labial palps with third segment 1/3 length of second, upturned, reaching to vertex. Patagia dark brown. Prothorax and tegulae black, meso- and meta-thorax dark brown. Hind tibia with outer spur of distal pair 1/2 length of inner spur. Fore wing, pattern as in Pl. 15, fig. 75, blackish brown. Terminal margin incised below apex, basal and median areas black, slightly lighter on posterior margins. Subterminal area light brown with fine reticulations. Underside, paler, median dark fascia narrowing posteriorly and similar, but paler, basal fascia. Hind wing without dark areas of fore wing, light brown, with darker reticulations and median dark spot and fringes. Underside similar.

GENITALIA ♂ (Pl. 39, fig. 216). Uncus simple, broad. Gnathus arms weakly sclerotized. Valve simple, with small, sclerotized, basal process. Juxta two, small, round lobes, covered with hairs. Tegumen with lightly sclerotized rod forming loop in median position. Aedeagus with spined vesica.

♀. Wing, 10 mm. Antennae minute ciliate. Apex of fore wing pointed (Pl. 15, fig. 76). Fringe with scales black at base, white at apex. Terminal margin incised below apex of fore wing. Costal margin dark, anterior part of median and basal areas blackish, rest of wing light brown with darker reticulations. Underside paler, median area with dark patch near anterior margin, smaller one in basal area.

GENITALIA ♀ (Pl. 62, fig. 382). Anal papillae short. Duct of bursa long with small sclerotized part near ostium. Two spiny patches in bursa, each with inward pointing process which is covered with spines.

DISCUSSION. Only three specimens of this species have been examined but the pattern is characteristic. There are slight differences between the type and the male from Ghana, this could be subspecific. The signa in the female are smaller than those of other species of the genus.

DISTRIBUTION. Map 54. Ghana; Tanzania; Zambia.

MATERIAL EXAMINED.

Holotype ♂, TANZANIA: Tendaguru, BM slide no. 9673, in ZMB.

GHANA: 1 ♂, Kete-Krachi, N. Territories (*Cardinall*); ZAMBIA: 1 ♀, Choma, ix.1956 (*Williams*).

Hypolamprus quaesitus **sp. n.**

(Pl. 16, fig. 79; Pl. 39, fig. 219; Pl. 62, fig. 383)

♂. Wing, 9–13·5 mm. Vertex dark brown, tuft of scales round base of antennae. Frons rounded. Antennae strongly monopectinate. Labial palps upturned, not reaching vertex, third segment 1/3 length of second. Thorax brown. Hind tibia with inner spur of distal pair more than 1/2 length of outer spur. Fore wing, pattern as in Pl. 16, fig. 79, reddish brown with pale grey-brown median fascia and pale grey-brown costal margin with white patches. Underside paler, pinkish brown with prominent dark brown median fascia and short dark mark from costal margin in subterminal position. Hind wing, as fore wing, $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 39, fig. 219). Uncus simple. Gnathus arms weakly sclerotized. Valve simple, median basal process lightly sclerotized. Juxta two rather square lateral lobes. Aedeagus with minute spines on vesica.

♀. Wing, 12·5 mm. Colour and pattern as male. Labial palps with third segment 1/2 length of second. Antennae minutely ciliate.

GENITALIA ♀ (Pl. 62, fig. 383). Anal papillae short. Bursa with two prominent, inward projecting, thorn-like spines.

DISCUSSION. This species has rather long, narrow fore wings each with a pointed apex. It is related to *H. distrinctus* from which it can be separated by the rather grey fascia of the wings and the shape of the genitalia. The antennae show sexual dimorphism as in *H. distrinctus*. The genitalia of *quaesitus* are similar to *curvifluus* but the spines in the female of *curvifluus* are larger and there are other genitalia differences. The grey fascia on the wings and the wing-shape make this species easily recognized.

DISTRIBUTION. Map 55. Democratic Republic of the Congo; Uganda; Kenya.

MATERIAL EXAMINED.

Holotype ♂, KENYA: S. Kavirondo, Suna, vi.1932 (*Feather*), BM slide no. 10634, in BMNH.

Paratypes. KENYA: 2 ♂, data as type, one ♂, ii.1932. 1 ♂, Kamasia, 4500 ft, 7.vii.1950 (*Evans*), in NMK; UGANDA: 1 ♂, Kakulo, Budu, 13.i.1936 (*Johnston*); 1 ♀, Entebbe, xi.1902 (*Rattray*); 1 ♂, Kisaru, 26.vi.1933 (*Johnston*), at light; 1 ♂, Bugoma Forest, 14.vi.1933 (*Johnston*); DEMOCRATIC REPUBLIC OF THE CONGO: 2 ♂, Dungu, Upper Uelle Distr., vii–viii.

***Hypolamprus gangaba* sp. n.**

(Pl. 15, fig. 78; Pl. 39, figs 217, 218; Pl. 62, figs 384, 385)

[*Rhodoneura bastialis* auct., nec Walker, 1859.]

♂. Wing, 8·5–9·5 mm. Vertex orange-brown, irrorate with white. Frons not projecting between eyes. Antennae minutely ciliate. Labial palps with third segment more than 1/2 length of second, upturned reaching vertex. Patagia light brown, rest of thorax paler. Hind tibia with inner spur of each pair much longer than outer spur ($2\frac{1}{2}$–$3\times$). Fore wing, pattern as in Pl. 15, fig. 78, white with brown and black transverse lines. Apex of wing white with two or three black spots. Costal margin brown. Underside, pattern as upperside but darker, apical white area more conspicuous. Hind wing, as fore wing, no white at apex. Veins $Sc+R_1$ and *Rs* approach closely but do not fuse.

GENITALIA ♂ (Pl. 39, figs 217, 218). Uncus simple, gnathus a weakly sclerotized loop. Valve simple, median basal process sclerotized, bifid, median arm with small spines. Juxta highly modified with spiny apical process, narrow, sclerotized lateral arms and two toothed projections from base. Aedeagus with spiny vesica.

♀. Wing, 7·5–12 mm. Colour and pattern as male.

GENITALIA ♀ (Pl. 62, figs 384, 385). Anal papillae short. Ostium with two sclerotized lateral lobes, covered with small spines. First part of duct sclerotized, with small spines, remainder of duct convolute. Two sclerotized thorn-like signa in bursa.

DISCUSSION. Some variation in colour exists, with a few specimens being darker brown than others. There is also some variation in pattern over the range which may be of subspecific nature but on material available this is not clear. Considerable variation occurs in size of specimens in the series examined, the females from West Africa tending to be smaller than females from South Africa. *H. gangaba* is very similar externally to *R. bastialis* Walker. It can be distinguished from this species by the shape of the signum in the female and the shape of the juxta in the male.

The lobate opening of the duct in the female *gangaba* is similar to *H. striatalis* Swinhoe. The males of these two species also have in common the spiny basal processes on the valve but the shapes are different. Records of *R. bastialis* in Africa (e.g. Dalle Torre, 1914 : 20) almost certainly refer to the new species described here. The highly modified juxta separates *gangaba* from the other species in the genus.

DISTRIBUTION. Map 55. Senegal; Sierra Leone; Ivory Coast; Ghana; Nigeria; Cameroon; Uganda; Kenya; Tanzania; Rhodesia; Angola; South Africa.

MATERIAL EXAMINED.

Holotype ♂, SOUTH AFRICA: Natal, Karkloof, 7.ii.[18]97 (*Marshall*), BM slide no. 10271, in BMNH.

Paratypes. SOUTH AFRICA: 2 ♂, 1 ♀, Natal, Durban, xi–xii.1954 (*Dickson*), one ♂, one ♀ in TMP; 1 ♀, Nkandhla Forest, 22.i.1916 (*Janse*), in TMP; 1 ♀, Karkloof, Natal, 18.i.1917 (*Janse*), in TMP; 2 ♂, Port St John, Pondoland, vii.1923 (*Turner*); 1 ♀, Kowyn's Pass, Pilgrims Rest Distr., 22.ii.1962 (*Vari & Leleup*), in TMP; 1 ♀. Woodbush, Transvaal, ix.1960 (*Vari & van Son*), in TMP; 1 ♂, 1 ♀, Woodbush, 1670 m, i.1925 (*Janse*), in TMP; 1 ♀, Natal, Durban, i.1902 (*Leigh*); 1 ♂, Impetyeni Forest, Natal (*Swinney*), i.1921, in TMP; 1 ♂, Mariepskop, Pilgrims Rest Distr., 23–26.ii.1962 (*Vari & Leleup*), in TMP; 2 ♀, Mariepskop, 15–24.iii.1965 (*Potgieter & van Son*), one ♀ in TMP; RHODESIA: 1 ♂, Bulawayo, 17.xii.1924 (*Stevenson*); 1 ♀, Vumba Mts, Umtali, 1953 (*Pinhey*), in NMK; 1 ♀, Salisbury Expt. Station, Light trap, i.1965, in NMR.

Material not included in type-series. SENEGAL: 1 ♀, Sedhiou, 1917 (*Castell*); SIERRA LEONE: 1 ♀, Port Lokko, v.1912 (*Simpson*); IVORY COAST: 4 ♀, Bingerville, viii.1915 (*Melou*); GHANA: 2 ♀, Ashanti (*Houston*); 1 ♀, Kumasi, ii (*Sanders*); NIGERIA: 1 ♀, Lagos, Oshodi, 1955; CAMEROON: 1 ♂, 1 ♀, Efulen (*Weber*), in CMP; UGANDA: 1 ♂, Entebbe, vi.1961, in NMR; 1 ♀, Bwamba, Toro (*Mitton*), ix.1961; KENYA: 2 ♀, Nderema, vi.1936 (*van Son*), one ♀, in TMP; 1 ♂, Mombasa (*Doherty*); TANZANIA: 1 ♀, Amani, Malaria Res. Institute (*Pringle*), v.1964; 1 ♂, Amani, vii.1966 (*Mackay & Watson*), in NMK; ANGOLA: 1 ♀, Fazenda, Congulu, Amboim Distr., 700–800 m, 12–16.iv.1934.

CORNUTERUS gen. n.

Type-species, *Siculodes nigropunctula* Pagenstecher.

The species described as *Hypolamprus trivius* Whalley from Madagascar (1967 : 36) is here transferred to this genus where it is closely allied to *C. paratrivius*. Both these species are known only from the female but both have the typical wing shape and bursal spines of the genus *Cornuterus*. *C. palairantus* is known only from one damaged specimen and is rather peculiar. It is only tentatively placed in this genus and may need a new genus when more specimens are examined. Tarsal spines are present in *palairantus* but are absent in other species of the genus. The genus has certain features of the genus *Microbelia* Warren in which the female has a large sclerotized cornutus but a more detailed comparison will have to await a revision of the genus *Microbelia*. The genus *Cornuterus* is found in Africa and Madagascar.

GENERIC DESCRIPTION. Eyes without interfacetal hairs. Labial palps 3-segmented. Proboscis present. Antennae minutely ciliate. Terminal margin of fore and hind wings usually sinuous. Radial veins of fore wing from cell. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Tarsi usually without spines. Male without gnathus. Female with large patch of spines in bursa.

BIOLOGY. No information.

KEY TO THE AFRICAN SPECIES OF *CORNUTERUS*

1 Fore wing brown with strong transverse striations. Terminal margin smooth. Tarsi with pair apical spines . . . . ***palairantus*** (p. 136)
– Fore wing sandy brown with grey-brown patches. Terminal margin sinuate. Tarsi without spines 2
2 (1) Female with broad duct. Two sclerotized signa in bursa (Pl. 62, fig. 388). Indistinct grey fascia, generally not parallel to margin of hind wing ***paratrivius*** (p. 135)
– Female with narrower duct. Single sclerotized signum (Pl. 62, fig. 387). Several broad grey fasciae on hind wing running parallel to wing margin ***nigropunctulus*** (p. 134)

Cornuterus nigropunctulus (Pagenstecher) **comb. n.**

(Pl. 16, fig. 82; Pl. 39, fig. 220; Pl. 62, fig. 387)

Siculodes nigropunctula Pagenstecher, 1892 : 109.
Rhodoneura seriata Warren, 1897 : 20. (Syn. by Hampson, 1897: 617).
Rhodoneura nigropunctula (Pagenstecher) Hampson, 1897 : 617.
Rhodoneura nigropunctula (Pagenstecher); Dalle Torre, 1914 : 29.
Rhodoneura nigropunctula (Pagenstecher); Gaede, 1917 : 365.
Rhodoneura nigropunctula (Pagenstecher); Gaede, 1929 : 491.

♂. Wing, 10·5–11·5 mm. Vertex brown; flattened, small tuft of scales over base of antennae. Labial palps with second segment broad, third segment 1/2 length of second, upturned, reaching above vertex. Thorax brown. Hind tibia with outer spur of distal pair slightly more than 1/2 length of inner spur. Hind tarsi without spines. Fore wing, pattern as in Pl. 16, fig. 82, grey-brown with darker median and subterminal areas showing on hind margin. Terminal wing margin slightly concave below apex. Small discal black spot. Vein *2A* reduced. Underside, pattern more clearly visible. Median and subterminal marks on hind margin black. Costal margin alternately black and grey-brown. Hind wing, colour as fore wing, pattern showing through from underside more clearly than fore wing. Anterior margin sinuate. Underside with prominent subterminal and median fascia, basal area lighter. Hind wing pointed, with sinuate margin below apex. $Sc+R_1$ and *Rs* free.

GENITALIA ♂ (Pl. 39, fig. 220). Uncus simple. Gnathus absent. Valves narrowed 1/2 way along length. Juxta large, with two broad arms, rounded at apex. Aedeagus with large patch of strongly sclerotized cornuti.

♀. Wing, 13·5–25 mm. Colour and pattern as male. Underside, pattern well marked.

GENITALIA ♀ (Pl. 62, fig. 387). Anal papillae short. Duct enlarged, minutely spined. Sclerotized patch of spines from neck extending partially round bursa.

DISCUSSION. Some variation was found between the genitalia of the female holotype and the females from West Africa. It is possible that the Nigerian specimens may represent a subspecies. In South African specimens, the circlet of spines on the bursa of the female are more slender than in the Tanzanian specimen. When

more specimens are available this species will probably be divided into several subspecies.

DISTRIBUTION. Map 52. Nigeria; Democratic Republic of the Congo; Tanzania; Malawi; South Africa.

MATERIAL EXAMINED.

Holotype ♀ (*nigropunctulus*), NATAL: BM slide no. 9713, in ZMB.

Holotype ♀ (*seriata*), TANZANIA: Dar-es-Salaam, BM slide no. 9962, in BMNH.

NIGERIA: 1 ♀, Old Calabar; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Dungu, Upper Uelle Distr., viii; MALAWI: 1 ♂, Mkuwadzi Forest, Nkata Bay, 5.v.1966, in NMR; 1 ♂, Zomba, xi.–xii.1923 (*Janse*), in TMP; SOUTH AFRICA: 1 ♀, Nelspruit, ii.1918 (*Breijer*), in TMP; 1 ♂, Sarnia (*Curry*), i.1914, in TMP; 1 ♂, Sibase, Transvaal (*Janse*), in TMP; 1 ♀, Hluhluwe, 9.xi.1928 (*Marley*).

Cornuterus paratrivius sp. n.

(Pl. 16, fig. 80; Pl. 62, figs 388–390)

♀. Wing, 10·5 mm. Vertex orange-brown. Labial palps long, 2 × diameter of eye, third segment almost as long as second. Frons produced slightly between eyes. Thorax orange-brown. Hind tibia with distal pair of spurs almost equal in length. Hind tarsi without spines. Fore wing, pattern as in Pl. 16, fig. 80, pale sandy brown with darker fascia. Underside with fascia prominent, almost black. Hind wing, colour and pattern as fore wing, terminal margin slightly incised below apex. $Sc+R_1$ and Rs free.

GENITALIA ♀ (Pl. 62, figs 388–390). Anal papillae short. Ostium broad and minutely spined. First part of duct narrow, widening to heavily sclerotized part, covered with spines. Large patch of spines in bursa, and one long Y-shaped sclerotized plate, the stem of the "Y" forming a large, slightly curved spine in the bursa.

♂. Unknown.

DISCUSSION. Although this species is known only from two female specimens, it is of interest for its similarity with *Cornuterus trivius* Whalley (comb. n.) from Madagascar, which is also known only from the female. Both species have very similar genitalia and external appearance. *C. paratrivius* can be separated from *C. trivius* by the much larger spine in the bursa and the presence of spines on the neck and first part of the bursa in *paratrivius*. The spines in the bursa of *C. trivius* are mainly on the middle of the bursa. The wing shape of both species is similar to *C. nigropunctulus*. Further material will be needed to determine the exact relationship of these species.

DISTRIBUTION. Map 52. Cameroon.

MATERIAL EXAMINED.

Holotype ♀, CAMEROON: Bitje, Ja River, x., wet season (*Bates*), BM slide no. 10608, in BMNH.

Paratype. CAMEROON: 1 ♀, Efulen, 11.xi.1918 (*Weber*), in CMP.

Cornuterus trivius (Whalley) comb. n.

Hypolamprus trivius Whalley, 1967 : 36, figs 9, 74.

DISTRIBUTION. Madagascar. Map 52.

Cornuterus palairantus (Bethune-Baker) **comb. n.**

(Pl. 16, fig. 81; Pl. 40, fig. 221)

Rhodoneura palairanta Bethune-Baker, 1911 : 542.
Rhodoneura palairanta Bethune-Baker; Dalle Torre, 1914 : 30.
Rhodoneura palairanta Bethune-Baker; Gaede, 1917 : 365.
Rhodoneura palairanta Bethune-Baker; Gaede, 1929 : 492.

♂. Wing, 14·5 mm. Head missing from holotype. Thorax badly damaged, only one fore leg present. Tarsi of fore leg each with pair of spines. Fore wing, pattern as in Pl. 16, fig. 81, brown with darker brown reticulations. Costal and terminal margins black, a faint white mark on costal margin. Fringe brown. Underside paler with slightly translucent appearance. R_4 and R_5 shortly stalked. Hind wing, pattern and colour as fore wing. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 40, fig. 221). Uncus simple, long and slender. Gnathus absent. Subscaphium lightly sclerotized. Valves simple with prominent median process. Juxta a large flat plate. Transtilla well developed. Aedeagus with spiny manica and a few spines in vesica.

♀. Unknown.

DISCUSSION. The holotype is badly damaged but sufficient remains of this specimen to provide problems for its generic position. The structure of the juxta is different from most other African Thyrididae, with the broad plate lacking the lateral arms which are characteristic of most other species. However, this type of juxta is also found in *nigropunctulus* and for this reason *palairantus* is placed tentatively in the same genus. It is possible that the abdomen might not be the original one but no trace of it having been refixed was found. No other specimens have been found to match this species. If the abdomen is the original, then on the characters available, this species will probably need a new genus. The presence of tarsal spines is unusual and is another reason why the present position is only regarded as tentative.

DISTRIBUTION. Map 52. Nigeria.

MATERIAL EXAMINED.

Holotype ♂, NIGERIA: 100 ml north of Lokoja (*Cator*), BM slide no. 9623, in BMNH.

BUPOTA gen. n.

Type-species, *Bupota tranquilla* sp. n.

This genus includes two species, one of which is separated into two subspecies. This species, *B. tranquilla*, has distinct male genitalia and is clearly separate from the other species, *B. galbana*. The latter species is very pale coloured and almost without the typical reticulate pattern. The genus is similar to *Collinsa* in the reduction of the hind tibial spur but differs in the ciliation of the antennae of the male and the shape of the genitalia. *Bupota* is also close to *Kalenga* in the shape of the wing and the ciliation of the antennae but the latter genus lacks the fusion of the radial veins of the fore wing. At present the genus *Bupota* is known only from Africa where it occurs in central and southern Africa. It is one of the few genera whose species are found in the extreme south of the continent.

GENERIC DESCRIPTION. Eyes without interfacetal hairs. Antennae ciliate in male, minutely ciliate in female. Labial palps 3-segmented, short. Proboscis present, often reduced. Fore

wing rather narrow usually with R_4+R_5. Fore tibia with epiphysis. Hind tibia with proximal spurs reduced. Tarsi without spines. Gnathus present in male genitalia. Bursa of female minutely spined.

BIOLOGY. No information.

KEY TO THE AFRICAN SPECIES AND SUBSPECIES OF *BUPOTA*

1		Sandy-yellow colour, reticulations indistinct	***galbana*** (p. 138)
–		Brown or orange-brown, often with white maculations	2
2	(1)	Brown, maculations indistinct. Wing over 10·5 mm	***tranquilla tranquilla*** (p. 137)
–		Orange-brown, distinct white maculations. Wing under 10·5 mm	***tranquilla scripta*** (p. 138)

Bupota tranquilla sp. n.

This species is divided into two subspecies on the basis of the colour pattern and the shape of the juxta. *B. t. scripta* is smaller than the nominate subspecies and more orange-brown with distinct maculations. It is possible, that when more material is examined, the status of the two subspecies will have to be revised. *B. tranquilla* has a very distinctive wing shape and the shape of the basal process in the male genitalia separate it from other African Thyrididae.

Bupota tranquilla tranquilla ssp. n.

(Pl. 14, fig. 71; Pl. 40, fig. 222; Pl. 63, fig. 391)

♂. Wing, 10·5–13·5 mm. Vertex brown with white scales in line across vertex from base of antennae. Antennae moderately ciliate. Frons flattened between eyes. Proboscis reduced. Labial palps very short, equal to diameter of eye, third segment only slightly longer than second. Patagia brown with white posterior band. Thorax brown. Hind tibia with one distal pair of spurs, outer spur almost equal in length to inner spur. Fore wing, pattern as in Pl. 14, fig. 71, dark reddish brown with small, inconspicuous, white maculations. Terminal margin dark, longer part of fringe white. Costal margin narrowly white with white spots. Underside, as upperside, maculations slightly clearer. Hind wings, colour as fore wing but with blacker scales near posterior angle. Underside paler than upper but with distinct black and white maculations in posterior area. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 40, fig. 222). Uncus simple. Gnathus a lightly sclerotized loop, no medial process. Valve simple, prominent sclerotized basal process with conspicuous rounded sclerotized plate near juxta. Juxta with sclerotized lateral lobes, spiny at apex. Aedeagus with strongly spined manica.

♀. Wing, 10 mm. Colour and pattern as male.

GENITALIA ♀ (Pl. 63, fig. 391). Anal papillae short. Ostium with lightly sclerotized edge. First part of neck lightly sclerotized. Bursa without spines.

DISCUSSION. The single pair of spurs on the hind tibia, the reduced proboscis and small labial palps separate this species from *K. maculanota*. The male genitalia of *B. t. tranquilla* and *B. t. scripta* are similar but the shape of the juxta is slightly different. Some colour variation exists in the series of *B. t. tranquilla* and the single female is much smaller than the male. The reduction of the tibial spur also occurs in *C. subscripta*.

DISTRIBUTION. Map 51. Rhodesia.

MATERIAL EXAMINED.

Holotype ♂, RHODESIA: Umvuma (*Carnegie*), 18.i.1918, BM slide no. 10588, in TMP.

Paratypes. RHODESIA: 1 ♂, Salisbury, i–iii.1957, in NMR; 2 ♂, Salisbury Expt. Station, light trap, xii.1955, one ♂ in NMR; 1 ♂, Salisbury, 31.xii.1917 (*Janse*), in TMP; 1 ♀, Salisbury, i.1963; 1 ♂, 2 ♀. Marandellas, xii.1961, one ♂, one ♀ in NMR.

Bupota tranquilla scripta ssp. n.

(Pl. 14, fig. 72; Pl. 40, figs 223, 224)

♂. Wing, 9–10·5 mm. Vertex brown, with white line of scales between antennae. Frons not projecting between eyes. Antennae ciliate. Proboscis reduced, scarcely visible between palps. Labial palps short, third segment 1/3 length of second. Thorax reddish brown. Hind tibia with one pair of spurs and single proximal spur. Fore wing, pattern as in Pl. 14, fig. 72, yellow-brown with darker transverse fascia. Fringe brown. Hind wing, pattern and colour as fore wing. $Sc+R_1$ and *Rs* free.

GENITALIA ♂ (Pl. 40, figs 223, 224). Uncus simple. Gnathus lightly sclerotized. Valves simple. Prominent sclerotized basal process with rounded, sclerotized plate, towards mid-line. Juxta with two elongate, rather spiny, lateral lobes. Aedeagus with strongly spined manica.

♀. Unknown.

DISCUSSION. From the nominate subspecies this can be separated by its smaller size, orange-brown colour and slight differences in the juxta. Externally this subspecies is similar to *K. maculanota* but lacks the round white spot at the apex of the cell of the fore wing and has less black scaling on the underside of the fore wing. The presence of a single, median proximal tarsal spur is found in *C. subscripta* from which *B. t. scripta* can be separated by the orange-brown colour and the lack of the row of black and silver scales which are found in the cell under the fore wing of *C. subscripta*. The single Angolan specimen is smaller than the Zambian specimens.

DISTRIBUTION. Map 51. Zambia; Angola.

MATERIAL EXAMINED.

Holotype ♂, ZAMBIA: Abercorn, ii.1955, BM slide no. 10285, in NMR.

Paratypes. ZAMBIA: 1 ♂, data as type; ANGOLA: 1 ♂, Cambo, Caquenje, Bihé, 3.xi.1904 (*Ansorge*).

Bupota galbana sp. n.

(Pl. 1, A; Pl. 40, fig. 225; Pl. 63, fig. 392)

♂. Wing, 8·5–10·5 mm. Vertex yellowish, frons slightly projecting between eyes. Antennae ciliate. Labial palps short, upturned, not reaching vertex, about $1\frac{1}{2}$ × diameter of eye; third segment 1/4 length of second. Thorax yellowish brown. Hind tibia with two pairs of very short spurs, proximal pair with one small and one minute spur, latter not visible through scales. Fore wing, pattern as in Pl. 1, A, pale orange-yellow, basal area with grey terminal and subterminal areas, with indistinct orange-brown reticulations. Underside, grey-white, almost unpatterned. Black spot in apex of cell just visible on upper and under sides. Costal margin slightly concave. Radial veins from cell. Hind wing, strongly reticulate with white ground colour, whole hind wing rather grey, underside similar. $Sc+R_1$ and *Rs* free.

GENITALIA ♂ (Pl. 40, fig. 225). Uncus simple. Gnathus present, with small median process.

Valve simple. Median basal process sclerotized. Juxta two lateral lobes, each with a few inward projecting spines. Aedeagus with few small spines on manica.

♀. Wing, 9–11 mm. Colour and pattern as male. Labial palps long, $2\frac{1}{2}$ × diameter of eye, upturned, third segment 1/4 length of second.

GENITALIA ♀ (Pl. 63, fig. 392). Anal papillae short. Ostium simple, not sclerotized. Duct covered with minute spines. Bursa without signum.

DISCUSSION. Some variation exists in intensity of colour, otherwise the pattern and colour of this species are constant. The labial palps show strong sexual dimorphism. The hind tibial spurs are very reduced, this occurs in both sexes and is similar to *B. tranquilla*. The relationship of these two species is not clear. The colour and pattern of *B. galbana* is unusual in the African Thyridid fauna and lead me to speculate that this species lives in rather drier areas than the others. From all other species *B. galbana* can be separated by the much reduced wing pattern and sandy yellow colour. The leftside wing in Pl. 1, A is the correct colour, the rightside wing has lost most of its colour.

DISTRIBUTION. Map 51. Rhodesia; Angola; Botswana; South West Africa; South Africa.

MATERIAL EXAMINED.

Holotype ♂, SOUTH WEST AFRICA: Abachaus [160 ml. north of Windhoek], xii.1943 (*Hobohm*), BM slide no. 10618, in TMP.

Paratypes. RHODESIA: 1 ♂, Sawmills (*Janse*), ii.1918, in TMP; 1 ♂, Bulawayo, 3.iii.1924 (*Stevenson*); 2 ♂, Balla Balla, xii.1955, one ♂ in NMR; 2 ♂, Khami, Matabeleland, i.1962, in NMR; ANGOLA: 1 ♂, Mucungo, 950 ft, 11.x.1930, Mossamedes Distr. (*Boulton*), in CMP; BOTSWANA: 1 ♂, 30 ml. NW. of Francis Town, 4.xi.1967 (*Pinhey*), in NMR; 1 ♂, between Palapye and Mahalapye, 25.i.1955 (*Rorke*), in TMP; SOUTH WEST AFRICA: 1 ♂, Abachaus, i.1947 (*Hobohm*); SOUTH AFRICA: 1 ♀, Shingwedzi, 29.iii.1952 (*Vari & Janse*), in TMP; 1 ♂, Blouberg, N. side Glenferness, Transvaal, 16–21.i.1955, in TMP; 1 ♂, Kransberg, ii.1932 (*van Son*), in TMP; 1 ♂, Wylies Poort, 5 m. north, 21–22.iii.1964 (*Janse*), in TMP; 1 ♀, Zoutpan, Zpbg., 15–30.xi.1932 (*van* Son); 1 ♂, Blauwkop, 30.i.1925 (*Janse*), in TMP.

COLLINSA Whalley

Collinsa Whalley, 1964a : 118. Type-species, *Dohertya roseopuncta* Warren, by original designation.

Dohertya Warren, 1902, preoccupied by *Dohertya* Hampson, 1894.

This genus contains one African species. Examination of other species in the Indo-Australasian region will almost certainly add more species to this genus and it is possible that a South American species (*Rhodoneura thiastoralis* Walker), may be placed in this genus. The genus is related to *Bupota* Whalley where the proximal pair of spurs are also reduced or modified but species of *Bupota* show some fusion of the radial veins of the fore wing and have very short labial palps. Species of *Collinsa* occur in Africa, the Indo-Australasian region, and perhaps, America. The genus is characterized by the reduction of one of the proximal spurs on the hind tibia and the elongate, slightly clavate, shape of the remaining proximal spur.

Generic description. Eyes without interfacetal hairs. Proboscis present. Antennae minutely ciliate. Labial palps, long, 3-segmented. Radial veins of fore wing from cell. Hind tibia with single, prominent, median spur, usually slightly clavate, and distal pair of spurs. Tarsi without spines. Fore tibia with epiphysis. Uncus in male usually broad at base. Lobes of juxta with medial spines.

Biology. No information.

Collinsa subscripta (Warren) **comb. n.**

(Pl. 16, figs 83, 84; Pl. 40, figs 226, 227; Pl. 59, figs 362, 363)

Pharambara subscripta Warren, 1899a : 7.
Rhodoneura subscripta (Warren) Dalle Torre, 1914 : 34.
Rhodoneura subscripta (Warren); Gaede, 1917 : 367.
Rhodoneura subscripta (Warren); Gaede, 1929 : 492.
[*R. thiastoralis* auct., nec Walker.]

♂. Wing, 8–10 mm. Vertex light brown. Labial palps with third segment 1/2 length of second, upturned, reaching vertex, palp 2 × diameter of eye. Hind tibia with distal pair of spurs as long as 1st hind tarsal segment. Proximal pair of spurs with one spur modified to form a long, thin, scale-like process with thickened end, other spur of proximal pair reduced, not visible through scale cover. Base of long proximal spur enlarged (covered by scales). Fore wing, pattern as in Pl. 16, figs 83, 84, light brown with darker brown transverse fascia and black-reticulations, often with purplish suffusion. Costal margin with faint brown and white markings. Underside with prominent scattering of black and silver scales along hind part of cell, with some at apex of cell. Hind wing, pattern as fore wing, often with purplish suffusion. No black scales on underside. $Sc+R_1$ and Rs approach closely but do not fuse.

Genitalia ♂ (Pl. 40, figs 226, 227). Uncus broad, narrowing near apex, base slightly produced laterally. Gnathus present with median process covered with minute spines. Juxta with two lateral lobes, apex of lobes produced on inner edge to form blunt process, inner edge of lobe with long spines. Valve simple, basal process weakly sclerotized. Aedeagus with mass of small cornuti.

♀. Wing, 9–9·5 mm. Colour and pattern as male. Hind tibia with inner spur of proximal pair modified, but not as strongly as male.

Genitalia ♀ (Pl. 59, figs 362, 363). Anal papillae short. Ostium covered with small spines, first part of duct lightly sclerotized, minutely spined. Bursa covered with minute spines.

Discussion. The modified tibial spurs are also found in *B. galbana* but the modifications are not as extreme as in *C. subscripta*. There is some variation in colour and pattern and there is probably some subspeciation but insufficient material was available to check this. A characteristic of this species is the single long, slightly clavate, proximal tibial spur. Externally this species is similar to *C. obstinata* but the genitalia are distinct. The strongly spined juxta is also found in *K. ansorgei* but this species can be separated from *subscripta* by the longer ciliations of the antennae, by the longer process of the gnathus and bigger spines in the aedeagus of *subscripta*. In the females, the two species can be separated by the shape of the ostium and the duct of the bursa.

Distribution. Map 50. Sierra Leone; Ivory Coast; Nigeria; Cameroon; Gabon; Uganda; Tanzania.

Material examined.

Holotype ♂, Nigeria: Warri (*Roth*), vi.[18]97, BM slide no. 9989, in BMNH.

SIERRA LEONE: 1 ♀, Bo (*Revell*), ix.1968; IVORY COAST: 4 ♀, Bingerville (*Melou*), iii–viii.1915; NIGERIA: 1 ♀, data as type; 1 ♀, U.C. Ibadan, iv.1958 (*Sutton*); 1 ♂, Cross River, Old Calabar; CAMEROON: 3 ♂, 2 ♀, Efulen (*Weber*), in CMP; GABON: 1 ♀, Kangwé, Ogové River (*Good*); Uganda: 1 ♂, Ruwenzori Range, Semliki Forest, 2850 ft, viii–ix.1952 (*Fletcher*); 1 ♀, Banda, xii.1906 (*Ansorge*); TANZANIA: 3 ♀, Amani, vii.1962 (*Pringle*); 1 ♂, Amani, 1934.

CUMBAYA gen. n.

Type-species, *Cumbaya obstinata* sp. n.

Although very little material is available of the two species of this genus, they are of interest for the differences in the genitalia of the males from those in other genera. The genus is probably near *Collinsa* Whalley but can be separated from this by the fusion of the radial veins of the fore wing. Externally, *C. obstinata* is similar to large specimens of *C. subscripta* but the remarkable spines in the aedeagus and the small teeth near the base of the valve separate *Cumbaya* from this and all the other Thyridid genera. The genus is known only from Africa, including the island of São Thomé in the Gulf of Guinea, but is absent from Madagascar.

GENERIC DESCRIPTION. Labial palps 3-segmented. Eyes without interfacetal hairs. Antennae minutely ciliate. Proboscis present. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Tarsi without spines. Fore wing with strongly angled terminal margin, veins R_3 and R_4 with common stalk. Gnathus of male a sclerotized loop, minutely spined in mid-line. Sclerotized teeth at base of valve near median basal process. Saccus slightly elongate. Aedeagus with strongly developed spines. Duct of bursa of female with small sclerotized plates on first part.

BIOLOGY: No information.

KEY TO THE AFRICAN SPECIES OF *CUMBAYA*

1 Yellowish brown species with distinct black spots. Aedeagus with two laterally directed spines . . . . **obstinata** (p. 141)
– Brown species, with less conspicuous spots. Aedeagus with numerous laterally directed spines . . . . **unigena** (p. 142)

Cumbaya obstinata sp. n.

(Pl. 17, fig. 86; Pl. 41, fig. 228; Pl. 63, figs 393–395)

♂. Wing, 10 mm. Vertex pale brown, frons rounded, not projecting between eyes. Labial palps with third segment almost equal in length to second, upturned, reaching vertex. Thorax pale brown. Hind tibia with inner proximal spur 1/3 length of outer spur. Distal pair with inner spur 1/2 length of outer. Fore wing, pattern as in Pl. 17, fig. 86, purplish brown with indistinct brown transverse fascia. Costal margin with white streaks along centre. Hind part of terminal margin deeply incised. Underside with prominent black and silver iridescent scales in cell and along base of anterior veins. Terminal area with white triangle extending backwards over apices of veins. Black spots between veins, subterminal black spot prominent. Hind wing, colour as fore wing, prominent black spots towards hind margin. Underside similar, heavily spotted with black. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 41, fig. 228). Uncus simple. Gnathus a weakly sclerotized loop, slightly enlarged on mid-line, with minute spines. Valve simple. Median basal process sclerotized

with toothed inward projection. Patch of spines on inner edge of sacculus near median basal process. Juxta distinctly tri-lobed, two lateral lobes more sclerotized than shorter median lobe. Aedeagus with very strongly sclerotized cornutus with two long spines at each end of plate and several smaller spines.

♀. Wing, 10·5–12 mm. Colour and pattern as male. Labial palps similar.

GENITALIA ♀ (Pl. 63, figs 393–395). Anal papillae short. Ostium enlarged and strongly spiny. First part of duct enlarged, covered with small sclerotized plates. Bursa covered with minute spines, larger on one side of bursa than the other.

DISCUSSION. The strongly spotted hind wings together with the angular shape of the fore wing make this species easily recognized. From the closely allied *C. unigena* it can be separated by the shape of the genitalia. The single specimen from São Thomé is larger than the Cameroons specimens but otherwise is indistinguishable. From *C. subscripta* this species can be separated by its larger size and heavier black spotting on the wings, the genitalia are quite different. Although little material of *C. obstinata* is available it has such distinctive genitalic structures that it warrants description.

DISTRIBUTION. Map 49. Ivory Coast; Cameroon; São Thomé Island (Gulf of Guinea).

MATERIAL EXAMINED.

Holotype ♂, CAMEROON: Efulen (*Weber*), 7.iv.1923, BM slide no. 10565, in CMP.

Paratypes. CAMEROON: 1 ♀, Efulen (*Weber*), 28.x.1913, in CMP; 1 ♀, Efulen (*Weber*), 11.iv.1913; 1 ♀, Efulen (*Weber*), 27.vi.1914, in CMP; SÃO THOMÉ: 1 ♀, 20.xi.1932 (*Tams*).

Material not included in the type-series. IVORY COAST: 1 ♀, Deimba, ii.1903 (*Pemberton*). [Specimen found subsequent to map production and not marked on Map 49.]

Cumbaya unigena **sp. n.**

(Pl. 17, fig. 85; Pl. 41, fig. 229)

♂. Wing, 12·5 mm. Vertex light brown. Antennae damaged, probably minutely ciliate. Frons rounded, not projecting between eyes. Labial palps with third segment almost equal in length to second, upturned, not reaching vertex. Thorax light brown. Hind tibia with inner spur of proximal pair 2 × length of outer, reaching almost to tip of shorter distal spur. Distal pair of spurs with outer spur 2/3 length of inner spur. First four hind tarsal segments without spines, last segment with a few spines. Fore wing, pattern as in Pl. 17, fig. 85, pale yellowish brown with purplish suffusion to subterminal and median areas. Indistinct transverse reticulations. Small black spot at apex of cell and a few black spots scattered over the wings. Hind part of terminal margin incised. Underside more heavily mottled with black than upper side. Black and silver iridescent scales in cell and along base of anterior veins. Pale, triangular-shaped area extending from apex of fore wing to $1A$. Black spot at apex of wing between veins, smaller black spots between $1A$ and R_5. Hind wing, upperside as fore wing, more black spots on wing margin, margin sharply angled. Underside heavily spotted with black. $Sc + R_1$ and Rs free.

GENITALIA ♂ (Pl. 41, fig. 229). Genitalia damaged, uncus probably lost. Gnathus a weakly sclerotized loop with minute spines on median part. Valve simple. Prominent toothed median basal process, several strongly sclerotized teeth on inner part of sacculus near median basal process. Juxta a broad plate with lateral arms. Sacculus slightly enlarged. Aedeagus with very elongate and strongly sclerotized spines on manica.

♀. Unknown.

DISCUSSION. Externally this species is rather similar to *C. obstinata* but the genitalia are distinct. Although there is only one damaged specimen, the characters are sufficiently distinctive for it to be recognized and it is the second known species of the genus *Cumbaya*. There is some external similarity to *C. subscripta* but *C. unigena* is larger and has more black spots on the wing, the genitalia are also distinct.

DISTRIBUTION. Map 49. Cameroon.

MATERIAL EXAMINED.

Holotype ♂, CAMEROON: Bitje, Ja River, 200 ft, x–xi.1912, BM slide no. 10056, in BMNH.

KALENGA gen. n.

Type-species, *Kalenga maculanota* sp. n.

This genus contains three species and is related to *Bupota* Whalley. It can be distinguished from this genus by the radial veins which arise from cell and the two long pairs of tibial spurs (the proximal pair are reduced in *Bupota*). *K. ansorgei* has several features which are not found in the other species of the genus. These include the spines on the inner lobe of the juxta, rather similar to *Collinsa subscripta*, and *ansorgei* may subsequently be placed in a separate genus. At present the genus *Kalenga* is only known from Africa where two of the three species (*maculanota* and *culanota*) seem to be restricted to Central Africa, whereas the third species (*ansorgei*) is widespread.

GENERIC DESCRIPTION. Labial palps 3-segmented. Eyes without interfacetal hairs. Antennae ciliate. Proboscis present. Radial veins of fore wing from cell, fore wings rather narrow. Two pairs of long tibial spurs. Tarsi without spines. Uncus slightly swollen below apex. Gnathus present.

BIOLOGY. *K. ansorgei* has been bred from galls on *Myrica* sp. (Myricaceae).

KEY TO THE AFRICAN SPECIES OF *KALENGA*

1 Reddish brown, narrow black or dark brown reticulations, male with prominent spines on inner margin of juxta . . . . . . **ansorgei** (p. 145)
– Dark brown, either with prominent white maculations or prominent white spot at apex of cell. Male without prominent spines on juxta 2
2 (1) Dark brown, white maculations obscure, prominent white spot at apex of cell of fore wing. Male without median process on gnathus . . **maculanota** (p. 143)
– Dark brown with prominent white maculations. Gnathus with prominent median process . . . . **culanota** (p. 144)

Kalenga maculanota sp. n.

(Pl. 1, L; Pl. 41, fig. 230; Pl. 63, fig. 396)

♂. Wing, 10·5–12·5 mm. Vertex brown, irrorate with white. Frons rounded, not projecting between eyes. White scales between antennae continuing as white line along anterior side of antennae. Antennae ciliate. Labial palps with third segment 1/2 length of second, slender, not reaching vertex, approximately $1\frac{1}{2}\times$ diameter of eye. Thorax brown. Hind tibia with longest proximal spur reaching to tip of shortest distal spur, outer spur of distal pair slightly more than 1/2 length of inner spur. Fore wing, pattern as in Pl. 1, L, reddish brown

with white maculations and a round, white spot at apex of cell. Basal area reddish brown. Fringe white. Underside, pattern as upperside, more black scales forming edges to white maculations. Hind wing, pattern as fore wing but maculations usually whiter with round white spot at apex of cell. Underside, as upper but with black edges to white maculations similar to underside fore wing. $Sc+R_1$ approaches Rs but does not join.

GENITALIA ♂ (Pl. 41, fig. 230). Uncus simple, slightly swollen near tip. Gnathus a simple loop without central process. Valve simple. Juxta two small lateral lobes with a few apical spines. Basal process on valve a lightly sclerotized plate. Sacculus slightly swollen. Aedeagus with minute spines in vesica.

♀. Wing, 11–13 mm. Colour and pattern as male.

GENITALIA ♀ (Pl. 63, fig. 396). Anal papillae short. Ostium simple, not heavily sclerotized. Bursa with small spines covering part of surface.

DISCUSSION. Some variation exists in the intensity of colouration and in some specimens a white spot is also present in the cell in the fore wing, in other specimens the maculations are more conspicuous. This species is similar to *K. culanota* (for separation see under that species). The dark brown colour and white spots on the wings, particularly at the apex of the cell, make this species easily recognized.

DISTRIBUTION. Map 70. Democratic Republic of the Congo; Zambia; Rhodesia.

MATERIAL EXAMINED.

Holotype ♂, ZAMBIA: Abercorn, v.1964 (*Vesey-Fitzgerald*), BM slide no. 10283, in BMNH.

Paratypes. ZAMBIA: 1 ♂, 2 ♀, data as type; 1 ♂, Abercorn, v.1967 (*I.R.L.C.S.*); 1 ♂, Abercorn, vi.1967 (*I.R.L.C.S.*), in NMK; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Elisabethville, iv.1930 (*Seydel*), in MRAC; 1 ♂, 1 ♀, Elisabethville, iv.1937 (*Seydel*), in MRAC; 2 ♂, Elisabethville, v.1950 (*Seydel*), in MNHN; 1 ♀, Elisabethville, iii.1952 (*Seydel*); RHODESIA: 1 ♀, Turk Mine, iv.1957, in NMR; 1 ♀, Umvuma (*Carnegie*), ii.1919, in TMP; 1 ♂, Salisbury, 17–19.ii.1950 (*Mitton*), in TMP; 1 ♀, Salisbury Expt. Station, light trap, iii.1956, in NMR.

Material not included in the type-series. ZAMBIA: 1 ♂, Ikelenge, Mwinilunga, v.1963, in NMR.

Kalenga culanota **sp. n.**

(Pl. 17, fig. 89; Pl. 41, fig. 231; Pl. 63, fig. 397)

♂. Wing, 6–10·5 mm. Vertex brown, white line of scales between antennal base continuing along antennae. Frons rounded, not produced between eyes. Antennae ciliate. Labial palps $1\frac{1}{2}\times$ diameter of eye, slender, third segment slightly less than 1/2 length of second. Thorax brown. Hind tibia with longest spur of proximal pair reaching to tip of shortest distal pair. Fore wing, pattern as in Pl. 17, fig. 89, brown and white, often with darker patch of scales at apex of cell. Terminal and costal margins brown. Fringe brown and white scales mixed. Hind wing, colour and pattern as fore wing, dark median mark near anterior margin of hind wing prominent. Underside as upper. $Sc+R_1$ and Rs run close together but do not join.

GENITALIA ♂ (Pl. 41, fig. 231). Uncus simple. Gnathus weakly sclerotized, with median process. Juxta two small lateral lobes. Valves simple. Median basal process sclerotized, plate-like. Aedeagus with minute spines in vesica.

♀. Wing, 8–10 mm. Colour and pattern as male.

GENITALIA ♀ (Pl. 63, fig. 397). Anal papillae short. Ostium simple, first part of duct lightly sclerotized. Duct covered with minute spines. Minute spines all over bursa.

DISCUSSION. This species is similar to *K. maculanota*. It can be separated from that species by the larger amount of white in the pattern of *culanota*. The round white spot on the fore wing of *maculanota* is not present in *culanota*. The males can be separated by the shape of the gnathus and the median basal process. The antennal ciliations are shorter in the male of *culanota* than in *maculanota*. The females can be separated by the shape of the first part of the duct and by the presence of some large spines in the bursa of *maculanota*, these are absent in *culanota*. Both species occur in Zambia and Rhodesia but the size variation in *culanota* is greater than in *maculanota*.

DISTRIBUTION. Map 71. Mozambique; Zambia; Rhodesia.

MATERIAL EXAMINED.

Holotype ♂, ZAMBIA: Abercorn, iv.1964 (*Vesey-Fitzgerald*), BM slide no. 10594, in BMNH.

Paratypes. MOZAMBIQUE: 1 ♀, Garuso, 15.ii.1950 (*Mitton*), in TMP; ZAMBIA: 1 ♀, Lake Chila, Abercorn, iv.1954 (*Pinhey*), in NMK; RHODESIA: 2 ♂, Umtali (*Mitton*), 14.ii.1950, one ♂ in TMP; 1 ♂, Mt Selinda, Melsettar, ii.1961, in NMR; 1 ♀, Salisbury Expt. Station, light trap, iii.1956, in NMR; 1 ♂, Marandellas, xii.1955.

Kalenga ansorgei (Warren) comb. n.

(Pl. 17, figs 87, 88; Pl. 41, figs 232, 233; Pl. 63, fig. 398)

Pharambara ansorgei Warren, 1899b : 289.
Banisia pusillata Warren, 1902 : 489, **syn. n.**
Banisia discata Warren, 1905 : 380, **syn. n.**
Rhodoneura ansorgei (Warren) Dalle Torre, 1914 : 19.
Rhodoneura pusillata (Warren) Dalle Torre, 1914 : 32.
Rhodoneura discata (Warren) Dalle Torre, 1914 : 22.
Rhodoneura ansorgei (Warren); Gaede, 1917 : 365.
Rhodoneura pusillata (Warren); Gaede, 1917 : 365.
Rhodoneura discata (Warren); Gaede, 1917 : 365.
Rhodoneura ansorgei (Warren); Gaede, 1929 : 494.
Rhodoneura pusillata (Warren); Gaede, 1929 : 492.
Dixoa discata (Warren) Gaede, 1929 : 496.

♂. Wing, 7·5–11 mm. Vertex brown. Antennae minutely ciliate. Labial palps with third segment 1/3 length of second, upturned, reaching vertex. Thorax brown. Hind tibia with outer spur of distal pair 1/2 length of inner spur. Inner spur almost equal in length to 1st hind tarsal segment. Fore wing, pattern as in Pl. 17, figs 87, 88, reddish brown with thin, black, median fascia, black spot at apex of cell and black reticulate pattern. Underside with more prominent transverse fascia. *1A* and *2A* fused near base to give single vein to wing margin. Hind wing, colour and pattern as fore wing. $Sc+R_1$ and *Rs* approach but do not join. R_1 very weak near base of wing.

GENITALIA ♂ (Pl. 41, figs 232, 233). Uncus simple. Gnathus lightly sclerotized as slender "U"-shaped piece. Valve simple, basal part of costa produced inwards, joining slender transtilla. Basal process spiny, with lateral tooth. Juxta with sclerotized lateral lobes, heavily toothed on inner margin of each lobe. Saccus slightly elongate. Vesica of aedeagus with minute spines, some small spines on manica.

♀. Wing, 8–11 mm. Colour and pattern as male.

GENITALIA ♀ (Pl. 63, fig. 398). Anal papillae short. Neck of duct sclerotized and spiny in first part. Prominent V-shaped ostium. Bursa covered with minute spines.

Discussion. Although a long series of this species have been examined it does not seem practical to separate it into subspecies. The species is widespread and variation occurs mainly in the number and size of the spines of the juxta of the male. This species has a similar type of juxta to *C. subscripta* but lacks the prominent median process of the gnathus. *K. ansorgei* has minutely ciliate antennae and has several other differences from *K. maculanota*, at present *ansorgei* is only tentatively placed in *Kalenga*. *K. ansorgei* has been bred from galls on *Myrica* sp. (Myricaceae).

Distribution. Map 72. Sierra Leone; Ivory Coast; Ghana; Nigeria; Cameroon; Democratic Republic of the Congo; Uganda; Tanzania; Kenya; Malawi; Zambia; Rhodesia; Angola; South West Africa; South Africa; Mauritius.

Material examined.

Holotype ♂ (*ansorgei*), Uganda: Masindi, 21.iv.[18]97 (*Ansorge*), BM slide no. 9576, in BMNH. Holotype ♀ (*pusillata*), Nigeria: Agberi, Niger, 31.viii.[19]01 (*Ansorge*), BM slide no. 9581, in BMNH. Holotype ♀ (*discata*), South Africa: Natal, Durban (*Leigh*), BM slide no. 9575, in BMNH.

Sierra Leone: 1 ♂, 1 ♀, Bo, vi.1967 (*Revell*); 1 ♀, Bo, i–iii.1969 (*Revell*); 1 ♂ (Clements); 1 ♀, Njala, vii.1932 (*Hargreaves*); Ivory Coast: 1 ♀, Bingerville, 1915 (*Melou*); Ghana: 1 ♀, Navaro, 11°N, 130°W, ii.1923 (*Cardinall*); 1 ♀, N. Territories, Kete Krachi (*Cardinall*); Nigeria: 1 ♂, 100 ml. N. of Lokoja (*Cator*); Cameroon: 1 ♂, Bitje, Ja River, dry season (*Bates*), 2000 ft; 3 ♂, Batanga, iv–vi.1912 (*Good*), in CMP; 2 ♂, 1 ♀, Efulen (*Weber*), in CMP; Democratic Republic of the Congo: 1 ♂, Elisabethville, xii.1939 (*Seydel*); 1 ♂, Katanga, Kipopo, Elisabethville, x–xi.1961 (*Maréchal*), in MRAC; 1 ♂, Elisabethville, v.1937 (*Sedyel*), in MRAC; 1 ♂, Katanga, Luashi, vi.1924 (*Seydel*), in MRAC; 1 ♀, Elisabethville, ii.1935 (*Seydel*), in MRAC; 1 ♀, Equateur, Bokuma, i.1941 (*Hulstaert*), in MRAC; 1 ♂, Katanga, Muchanga, Kilima, vii.1930; 1 ♂, Tshuapa, Bokotola, vi.1954 (*Hulstaert*), in MRAC; 1 ♂, Tshuapa, Bamanya, i.1967 (*Hulstaert*), in MRAC; 1 ♂, Kinsia-Tombola, x.1921 (*Verlaine*), in MRAC; 1 ♂, Arebe, W. of L. Albert; Uganda: 2 ♂, Ruwenzori Range, 2850 ft, Semliki Forest, viii–ix.1952 (*Fletcher*); 1 ♂, Kampala, Kanyumusenka, vii.1931 (*Hargreaves*); 1 ♀, Nyabyeya, at light, vi.1960 (*Brown*); 1 ♂, 2 ♀, Kampala, vii.1931 (*Hargreaves*); Tanzania: 1 ♀, Mwandui, Shinyanga (*Croft*), x.1951, in NMK; 1 ♀, Kilwa, i.1900 (*Reimer*); Kenya: 1 ♀, Nairobi, viii.1957 (*Leakey*), in NMK; 1 ♀, Nairobi, iii.1958 (*Goodal*), in NMK; Mozambique: 1 ♂, Rikaila, xii.1918 (*Janse*), in TMP; Malawi: 2 ♂, Maiwale, i-xii.1929 (*Lamborn*); 1 ♂, Mt Mlanje, ii.1914 (*Neave*); 1 ♂, Zomba, 6000 ft (*Barlow*), in USNM; Zambia: 1 ♂, Lake Chilwa, Abercorn, iv.1954 (*Pinhey*), in NMK; Rhodesia: 1 ♂, 2 ♀, Khami, Bulawayo, xii.1955, one ♂, one ♀ in NMR; 1 ♂, Imbega Valley, ii.1957, ex *Myrica* gall (*Krauss*); Angola: 1 ♂, xii.1904 (*Ansorge*); 1 ♂, Ceramba, Bihé, iii.1903 (*Bell*); 1 ♂, Bihé, xi.1901 (*Pemberton*); 1 ♂, N. Bailundu, viii.1901 (*Pemberton*); South West Africa: 1 ♂, Gabus, xi.1941 (*Meyer*), in TMP; 1 ♂, Ovampoland, Erikasor, xi.1888; South Africa: 1 ♂, Durban (*Leigh*), xi.1901; 2 ♂, Pretoria N. (*van Son*), in TMP; 1 ♀, Zululand, Empangeni, x.1913 (*Janse*); 1 ♀, Zululand, St Lucia Bay, x.1919, in TMP; 2 ♀, Pine Town, ii.1909 (*Leigh*); 2 ♀, Marieps Mts (*van Son*), xii.1925, in TMP; 1 ♂, 2 ♀, Karkloof, Natal, i.1917 (*Janse*), one ♂, one ♀ in TMP; 1 ♂, Rustenburg, xii.1958 (*Rorke*), in TMP;

1 ♂, Transvaal (*Cook*), xi.1908; 2 ♂, Natal, Sarnia, i.1912 (*Janse*), in TMP; 1 ♂, Sarnia, xi.1913 (*Curry*), in TMP; MAURITIUS: 1 ♂, ii.1922 (*Leigh*).

NAKAWA gen. n.

Type-species, *Rhodoneura fuscibasis* Hampson.

The two species in this genus have white coloured wings. *Nakawa* is allied to *Nemea* Whalley, from which it can be separated by the straight margin of the fore wing, usually sinuous in *Nemea*, and the prominent juxta lobes. The male of *N. fulvipicta* is unknown and the placing of this species in *Nakawa* is only tentative. The genus is only known from Africa.

GENERIC DESCRIPTION. Proboscis present. Antennae minutely ciliate. Labial palps 3-segmented, long, 1-1½ × diameter of eye. Eyes without interfacetal hairs. Fore tibia with epiphysis. Two pairs of spurs on hind tibia. Tarsi without spines. Radial veins from cell. Gnathus of male genitalia a sclerotized loop. Juxta with long lateral lobes. Female with many minute spines on neck and duct of bursa.

BIOLOGY. No information.

KEY TO THE AFRICAN SPECIES OF *NAKAWA*

1 Wing over 12·5 mm. Apex of fore wing with two black spots, broad, grey, median fascia, incomplete anteriad . . . . ***fuscibasis*** (p. 147)
– Wing under 12·5 mm. Apex of fore wing without black spots, usually with small, white, angled line. Median fascia indistinct . . . . ***fulvipicta*** (p. 148)

Nakawa fuscibasis (Hampson) **comb. n.**

(Pl. 2, A; Pl. 42, fig. 234; Pl. 63, fig. 399)

Rhodoneura fuscibasis Hampson, 1910 : 489.
Rhodoneura fuscibasis Hampson; Dalle Torre, 1914 : 23.
Rhodoneura fuscibasis Hampson; Gaede, 1917 : 365.
Rhodoneura fuscibasis Hampson; Gaede, 1929 : 493.

♂. Wing, 12·5–15 mm. Vertex brown, frons rounded. Labial palps protruding in front of head, third segment 1/2 length of second. Labial palps 1½ × diameter of eye. Thorax brown. Hind tibia with outer spur of distal pair 1/2 length of inner. Fore wing, pattern as in Pl. 2, A, white with grey median area and costal margin and brown basal area. Small brown spot below apex of wing, black dots between veins subapically. Underside similar, rather more yellow-brown colour. 1*A* and 2*A* join to form one vein to wing margin. Hind wing, whiter than fore wing, two pale, median, grey fascia, a subterminal yellow mark with one or two black spots subapically. Underside, as upperside.

GENITALIA ♂ (Pl. 42, fig. 234). Uncus simple, hairy. Gnathus weakly developed. Valves simple, hairy. Juxta, two lobes. Vesica of aedeagus with many short, strongly sclerotized spines.

♀. Wing, 15–19 mm. Colour and pattern as male. Labial palps with third segment almost equal to second. Labial palps projecting well in front of head, 2 × diameter of eye.

GENITALIA ♀ (Pl. 63, fig. 399). Anal papillae short. Part of neck of duct covered with small sclerotized plates. Bursa covered with minute spines, no signum.

DISCUSSION. The pale colour with a yellow-ochre tinge to the marks of the fore wing make this an easily recognized species. It is much paler than *R. sordidula*

Plötz and has an almost completely white hind wing with little trace of pattern. Little variation in pattern was found but some variation in intensity of colour occurred.

DISTRIBUTION. Map 71. Democratic Republic of the Congo; Tanzania; Malawi; Zambia; Rhodesia.

MATERIAL EXAMINED.

LECTOTYPE ♂, here designated; DEMOCRATIC REPUBLIC OF THE CONGO: 150–200 west of Kambove, 3500–4500 ft, 29.x.1907, BM slide no. 9610, in BMNH.

DEMOCRATIC REPUBLIC OF THE CONGO: 2 ♂, 2 ♀, data as type (paralectotypes); 1 ♀, Kafakumba, 12.x.1924; 1 ♀, Kafakumba, xii.1928; 1 ♂, Katanga, Zohindzi, xi.1933 (*Seydel*), in MRAC; 1 ♀, Lulua, Sandoa (*F.G.O.*), iv.1932; 7 ♂, 1 ♀, Katanga distr., Sandoa, x.1934; TANZANIA: 2 ♂, Amani, E. Usambara (*Carcasson*), xi.1965, in NMK; 1 ♀, Amani (*Pringle*), xii.1964; MALAWI: 1 ♂, Lenibe, i–ii.1926 (*Barlow*); ZAMBIA: 2 ♂, Solwezi, iii–xii.1917 (*Dollman*); 1 ♂, Mwinilunga, i.1957, in NMR; RHODESIA: 1 ♀, Wankie (*Tyler*), xi.1926, 2 ♂, Deka River, 5 ml. NE. of Wankie, ii.1968 (*Pinhey*), 1 ♂ in NMR.

Nakawa fulvipicta (Hampson) **comb. n.**

(Pl. 17, fig. 90; Pl. 63, fig. 400)

Rhodoneura fulvipicta Hampson, 1914 : 114.
Rhodoneura fulvipicta Hampson; Gaede, 1929 : 493.

♀. Wing, 10·5–12·5 mm. Vertex and frons white. Base of antennae with few black scales. Labial palps upturned, reaching above vertex, third segment approximately equal to second. Thorax very pale brown. Hind tibia with outer spur of distal pair slightly more than 1/2 length of inner spur. Fore wing, pattern as in Pl. 17, fig. 90, greyish white, with slightly darker patches, white apical marks with brown scales subapically. Underside of fore wing with reddish brown colour anterior to cell, black scales along veins. Two oval patches (only faintly visible on upperside), outer patch darker than inner patch, under fore wing. Prominent white, slightly "L"-shaped subapical line. Hind wing, colour as fore wing, brown patch in hind part of median area. Underside paler. $Sc+R_1$ and Rs free.

GENITALIA ♀ (Pl. 63, fig. 400). Anal papillae short. Ostium covered with small spines. Narrow sclerotized portion of duct near ostium. No signum. Neck of duct and bursa covered with minute spines (fig. 400 shows prominent mark along one side of bursa, this is an artifact due to the folding of the bursa).

♂. Unknown.

DISCUSSION. The underside wing pattern is characteristic of this species. Only two female specimens are known, the type is not a male as stated in the original description. The labial palps are long, $2\frac{1}{2}\times$ diameter of the eye. Externally this species is similar to *E. vocata* Whalley but lacks the fusion of the radial veins found in that species. The white streak at the apex of the fore wing is very distinct. Neither of the two known specimens of this species gives information on the localities and even the generic placing is tentative.

DISTRIBUTION. West Africa. (No map given because of lack of locality data).

MATERIAL EXAMINED.

Holotype ♀, West Africa (*Dudgeon*), 1908, BM slide no. 9618, in BMNH.
1 ♀, no data, probably West Africa, in CMP.

NEMEA gen. n.

Type-species, *Rhodoneura eugrapha* Hampson.

This genus contains five species but the females of two of them are unknown. It is related to *Sijua*, from which it can be separated by the lack of the Y-shaped tergite in the males and by the length of the gnathus, which is usually longer in *Nemea*. Although in external pattern *Nemea nivosa* looks very similar to *N. eugrapha*, there are several differences in the genitalia which are not found in other species of *Nemea*. *N. betousalis* is unusual in the African Thyrididae in having sexual dimorphism of pattern and colour. There is, however, some element of doubt in the association of males and females in this species. Species of *Nemea* are at present known only from Africa.

Generic description. Eyes without interfacetal hairs. Antennae minutely ciliate. Proboscis present. Labial palps 3-segmented. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Tarsi without spines. Fore wing with radial vein usually from cell. Hind margin of fore wing usually sinuous. Gnathus present, often elongate. Female with minutely spined bursa.

Biology. No information.

Key to the African Species of *NEMEA*

1		Large species, over 14 mm wing, ground colour snowy white, gnathus of male enlarged	***nivosa*** (p. 151)
–		Large or small species, ground colour usually other than white	2
2	(1)	Ciliate antennae in male. Genitalia as in Pl. 43, fig. 242. Female usually with black patch medially on hind margin of fore wing . .	***betousalis*** (p. 153)
–		Minutely ciliate antennae. Genitalia not as above. Females without black patch on fore wing	3
3	(2)	Ground colour pale yellow-brown. Prominent brown patch in angle formed by termen and hind margin of fore wing, narrow median fascia to fore wing	***eugrapha*** (p. 149)
–		Dark brown or purplish brown species	4
4	(3)	Dark brown ground colour, gnathus without median process . .	***tamsi*** (p. 150)
–		Purplish brown ground colour. Gnathus with median process .	***ankole*** (p. 152)

Nemea eugrapha (Hampson) **comb. n.**

(Pl. 18, fig. 91; Pl. 42, figs 236–238; Pl. 64, figs 401, 402)

Rhodoneura eugrapha Hampson, 1906 : 118.
Rhodoneura alenica Strand, 1913 : 59. (Synonymised by Gaede, 1917 : 359).
Rhodoneura eugrapha Hampson; Dalle Torre, 1914 : 22.
Rhodoneura thermographa Hampson, 1914 : 111, **syn. n.**
Rhodoneura alenica Strand; Gaede, 1917 : 359.
Rhodoneura eugrapha Hampson; Gaede, 1917 : 359.
Rhodoneura thermographa Hampson; Gaede, 1917 : 364.
Rhodoneura eugrapha Hampson; Gaede, 1929 : 491.
Rhodoneura thermographa Hampson; Gaede, 1929 : 491.

♂. Wing, 14–21 mm. Vertex pale brown. Labial palps with third segment 1/4 length of

second, upturned, not reaching vertex. Thorax, patagia, light brown, darker brown across mesothorax. Hind tibia with outer spur of distal pair slightly more than 1/2 length of inner spur. Fore wing, pattern as in Pl. 18, fig. 91, yellow-brown with darker brown reticulations. Veins *1A* and *2A* join near base, *2A* very reduced, not reaching wing margin. Hind wing, colour as fore wing. $Sc+R_1$ and *Rs* free.

GENITALIA ♂ (Pl. 42, figs 236–238). Uncus simple. Gnathus present, covered with minute spines on median projection. Valve simple, basal process a narrow elongate strip. Juxta with lateral arms slightly incurved at apex. Aedeagus with spiny vesica.

♀. Wing, 14–25 mm. Colour and pattern as in male. Labial palps with third segment nearly equal in length to second segment, upturned, reaching vertex.

GENITALIA ♀ (Pl. 64, figs 401, 402). Anal papillae short. Ostium simple. First part of duct lightly sclerotized with minute spines. Bursa partly covered with minute spines.

DISCUSSION. Variation in the colour occurs, with some specimens being darker than others. There is also some variation in the intensity of the reticulate pattern which is more extensive and darker in the specimens with a darker ground colour. Specimens from Gabon are much smaller than the others and may represent a subspecies but there is some overlap in size. Externally this species is similar to *N. nivosa* but it can be separated from this species by the yellow-brown (not white) colour of the wings. The shape of the juxta of the male is similar to species of *Opula* but *eugrapha* lacks the signum in the female which is characteristic of species of *Opula*.

DISTRIBUTION. Map 69. Sierra Leone; Liberia; Ghana; Nigeria; Cameroon; Rio Muni; Gabon, Republic of the Congo; Democratic Republic of the Congo.

MATERIAL EXAMINED.

LECTOTYPE ♂ (*eugrapha*), here designated, GHANA: Coomassie [Kumasi] (*Whiteside*), *Rhodoneura eugrapha* Hampson, BM slide no. 9046, in BMNH. Holotype ♂ (*alenica*), RIO MUNI: Alen, Benitogebiet, in ZMB. Holotype ♀ (*thermographa*), NIGERIA: Ilesha (*Humfrey*), BM slide no. 9615, in BMNH.

SIERRA LEONE: 1 ♀, 1898; LIBERIA: 2 ♂, Nimba, Grassfield, vii–ix.1967 (*Forbes-Watson*); GHANA: 1 ♂, Wassaw Distr., 45 ml inland from Sekondi; 1 ♂, Coomassie (*Whiteside*), (paralectotype); 1 ♂, 1 ♀, Takwa (*James*); 1 ♂, Bibianaha, x.1911 (*Spurrell*); CAMEROON: 1 ♀, Bitje, dry season, 1913; 1 ♀, Bitje, Ja River, x, wet season (*Bates*); 6 ♂, Efulen, 1922–25 (*Weber*), five ♂ in CMP; GABON: 1 ♀, Sevene de Mwadhi, iii.1963 (*Bernardi*); 3 ♂, Makokou, 500 m, Miss. Biologique, iii.1962 (*Bernardi*), in MNHN; 3 ♂, 1 ♀, Belinga, 600 m, Camp Centrale, iii.1962, two ♂, one ♀ in MNHN; REPUBLIC OF THE CONGO: 1 ♀, Ftoumbi, Moyen Congo, ii.1962 (*Jackson*), in NMK; DEMOCRATIC REPUBLIC OF THE CONGO: 2 ♂, Loile River, Ikela, Equateur, iv.1959 (*Carcasson*) 1 ♂ in NMK; 1 ♂, Kilo, ix.1936 (*Thalmau*), in MRAC; 1 ♀, Sankuru, Djeke, xi.1952 (*Fontaine*), in MRAC; 1 ♀, Bena Dibele, Sankuru, Kasai, iv.1959 (*Carcasson*), in NMK; 1 ♀, Elisabethville, v.1931 (*de Loose*), in MRAC; 2 ♂, Opala, Lomami R., Prov. Orientale, iii.1959 (*Carcasson*), one ♂ in NMK.

Nemea tamsi **sp. n.**

(Pl. 18, fig. 92; Pl. 42, fig. 235)

♂. Wing, 14·5–17 mm. Vertex reddish brown. Labial palps with third segment 1/3 length of second, upturned, just reaching vertex. Frons reddish brown, not projecting between

eyes. Thorax reddish brown. Hind tibia with outer spur of distal pair slightly more than 1/2 length of inner spur. Fore wing, pattern as in Pl. 18, fig. 92, reddish brown with darker brown transverse fasciae. Costal margin and basal area brown, fringe brown. Underside paler. Radial veins from cell. Hind wing, colour and pattern as fore wing. $Sc+R_1$ and Rs approach closely but do not join.

GENITALIA ♂ (Pl. 42, fig. 235). Uncus simple. Gnathus lightly sclerotized, median part very lightly sclerotized and slightly spiny. Valve simple with pointed, sclerotized, median basal process. Juxta with two membraneous lateral lobes and two sclerotized lobes. Area round transtilla minutely spined. Aedeagus with vesica minutely spined.

♀. Unknown.

DISCUSSION. This species shows some similarities to *Opula impletalis* Walker but differs in the shape of the gnathus and the straight, not incurved, lobes of the juxta. Superficially it is similar to *ankole* and *eugrapha* but can be distinguished by the genitalia. The exact relationship of this island species to the mainland species is not clear, it is probably derived from *N. eugrapha* but a closer comparison will have to await the discovery of a female.

DISTRIBUTION. Map 69. Fernando Po (West Africa).

MATERIAL EXAMINED.

Holotype ♂, FERNANDO PO: Moka, 29.i.1933 (*Tams*), BM slide no. 9913, in BMNH.
Paratype. FERNANDO PO: 1 ♂, Moka, 28.i.–3.ii.1933 (*Tams*).

Nemea nivosa sp. n.

(Pl. 18, fig. 93; Pl. 42, figs 239, 240; Pl. 64, figs 403, 404)

♂. Wing, 14–18·5 mm. Vertex light brown. Antennae moderately ciliate. Labial palps with third segment equal in length to second, upturned, not reaching vertex. Patagia brown, rest of thorax white. Hind tibia with outer spur of distal pair 1/2 length of inner; longest spur of distal pair slightly less than 1/2 length of inner and less than 1/2 length of 1st hind tarsal segment. Fore wing, pattern as in Pl. 18, fig. 93, snowy white with thin brown reticulations. Underside darker, dark basal area. R_4 and R_5 shortly stalked in a few specimens. Hind wing, as fore wing but with slightly heavier patterning on upper side. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 42, figs 239, 240). Uncus simple, long. Gnathus with median process greatly enlarged and spiny. Valves long, simple. Basal process a large plate, together with large spiny pouch. Juxta two small lobes, spiny at apex. Aedeagus without cornuti.

♀. Wing, 16–19·5 mm. Colour and pattern as male. Labial palps long 2 × diameter of eye, third segment of labial palp equal in length to second segment. Antennal ciliations shorter than male.

GENITALIA ♀ (Pl. 64, figs 403, 404). Anal papillae short. Ostium lightly sclerotized. Duct long and minutely spined. Bursa covered in minute spines.

DISCUSSION. Externally this species is similar to *eugrapha* but is distinguished by the white coloured wings and very distinct genitalia. The enormous development of the gnathus with its spiny covering and the enlargement of the basal process of the valve into a spiny pouch are peculiar to this species. Variation is mainly in size and intensity of the pattern. Specimens from the Cameroon have larger spines on the gnathus than those from the Congo, these larger spines are also found in specimens from Rhodesia. There is a tendency for some of the Rhodesian specimens to be darker and smaller than other specimens. This species is fairly widespread over Africa and on material available it is probable that the Rhodesian

and Cameroon specimens represent a different subspecies from the Congo-Uganda specimens, but the differences are not large and further specimens are needed. Externally this species has a similar pattern to some of the species in *Chrysotypus* but the genitalia are distinct.

DISTRIBUTION. Map 70. Cameroon; Gabon; Republic of the Congo; Democratic Republic of the Congo; Uganda; Tanzania; Rhodesia; South West Africa.

MATERIAL EXAMINED.

Holotype ♂, UGANDA: Bwamba, vi.1956 (*Carcasson*), BM slide no. 10487, in BMNH.

Paratypes. UGANDA: 1 ♂, 1 ♀, Bwamba, ii–iii.1957 (*Carcasson*), one ♂ in NMK.

Material not included in the type-series. CAMEROON: 1 ♀, Bitje, Ja River, x., wet season (*Bates*); 1 ♂, Batanga, xi.1911 (*Good*), in CMP; 22 ♂, 3 ♀, Efulen (*Weber*), 1921–29, twenty ♂, two ♀, in CMP; GABON: 4 ♂, Belinga, 600 m, Camp Centrale, 28–29.iii.1963 (*Bernardi*), three ♂ in MNHN; 1 ♂, Kangwe; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♀, South side, Middle Lowa Valley, S. of Walikali, W. Kivu, 3500 ft, forest, wet season, iii.1924 (*Barns*); 1 ♂, Uele, Paulis, 5.ii.1958 (*Fontaine*), in MRAC; 1 ♂, Lusambo, 23.xi.1949 (*Fontaine*), in MRAC; REPUBLIC OF THE CONGO: 1 ♂, Brazzaville, Kindamba, Meya Settlement, 10.xi.1963 (*Endrody-Younga*), in HNHM; TANZANIA: 1 ♂, Kigoma, Mukuyu, xi.1963 (*Jap. Primate expd.*), in NMK; RHODESIA: 1 ♂, Umvuma, 20.xii.1917 (*Janse*), in TMP; 1 ♂, Umvuma (*Carnegie*), iii.1919, in TMP; 1 ♀, Umvuma, i.1918, in TMP; 1 ♂, Xmas Pass, Umtali, 8.i.1927 (*Lannin*), in TMP; 4 ♂, Marandellas, iv–x.1960–i.1961, 3 ♂ in NMR; 1 ♂, Hunters Road, xii.1917 (*Wharley*), in TMP; SOUTH WEST AFRICA: 1 ♂, Andara, Okavango, i.1956 (*de Winter*), in TMP.

Nemea ankole sp. n.

(Pl. 18, figs 94; Pl. 43, fig. 241)

♂. Wing, 13 mm. Vertex dark brown. Frons dark brown, rounded, not projecting between eyes. Labial palps with third segment 1/2 length of second segment, upturned, reaching vertex. Prothorax and patagia black, rest of thorax brown. Hind tibia with outer spur of distal pair 2/3 length of inner spur. All spurs with sclerotized points. Fore wing, pattern as in Pl. 18, fig. 94, "granular" grey-brown with slightly purplish iridescence. Median fascia darker brown. Underside with slight purple iridescence, dark coloured, median fascia less distinct than upperside. Radial veins from cell. Hind wing, colour and pattern as fore wing. $Sc+R_1$ and Rs approach but do not join.

GENITALIA ♂ (Pl. 43, fig. 241). Uncus simple. Gnathus with long median process. Median basal area of valve lightly sclerotized. Juxta, two oval, lightly sclerotized lobes. Aedeagus with spiny vesica.

♀. Unknown.

DISCUSSION. This species is distinct from the others in the genus and does not appear to be closely related to them. The pattern shows some similarities to *N. tamsi* but this species lacks the long median process to the gnathus. The position of *ankole* in the genus *Nemea* is only tentative, particularly in the absence of information from female specimens.

DISTRIBUTION. Map 69. Uganda.

MATERIAL EXAMINED.

Holotype ♂, UGANDA: Ankole, Kalinzu Forest, xi.1961 (*Carcasson*), BM slide no. 10599, in BMNH.

Paratype. UGANDA: 1 ♂, data as type.

Nemea betousalis (Gaede) **comb. n.**

(Pl. 18, figs 95, 96; Pl. 43, fig. 242; Pl. 64, figs 405, 406)

Rhodoneura betousalis Gaede, 1917 : 376.
Rhodoneura bryaxis Fawcett, 1917 : 246, **syn. n.**
Rhodoneura betousalis Gaede; Gaede, 1929 : 494.
Rhodoneura bryaxis Fawcett; Gaede, 1929 : 494.

♂. Wing, 11 mm. Vertex and frons brown. Antennae ciliate. Labial palps upturned, just reaching vertex, third segment 1/2 length of second. Prothorax pale brown, rest of thorax white. Hind tibia with outer spur 1/2 length of inner spur. Fore wing, pattern as in Pl. 18, fig. 95, white with brown reticulate pattern. Basal area brown. Several black spots between veins subapically. Costal margin slightly concave, fringe brown. Underside colour and pattern as upperside. Hind wing, colour as fore wing but basal area white. Median black spot in cell on brown median fascia. Underside, as upperside. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 43, fig. 242). Uncus simple, broad at base, gradually narrowing. Gnathus present with small median projection. Valve simple. Median basal process of valve well developed and sclerotized with spiny pad on base of valve, anterior to basal process. Juxta, two lateral lobes with hairs on a slightly thickened basal plate. Saccus elongate. Aedeagus with manica toothed on one side and small spines over rest of manica.

♀. Wing, 11·5–13 mm. Vertex and frons brown. Antennae minutely ciliate. Labial palp upturned, just reaching vertex, third segment 1/2 length of second. Legs as male. Fore wing, pattern as in Pl. 18, fig. 96, brown with broad, dark brown, median fascia reaching from hind margin of cell. Rest of pattern as male. Hind wing pattern as male, median brown fascia right across wing. Black spot on median fascia prominent. Underside, as upperside. Venation as in male.

GENITALIA ♀ (Pl. 64, figs 405, 406). Anal papillae short. Ostium broad, covered with small spines. Duct of bursa strongly spined. Signum absent. Bursa with a few spines.

DISCUSSION. The females of this species are much darker than the two males examined. The females vary considerably in intensity of colour, particularly of the dark patch on the wing. The male specimens lack most of the antennal segments but the basal segments are more strongly ciliate than the female. This species has very distinctive male genitalia and seems to be most closely allied to the *eugrapha-nivosa* species-group. It can be separated from these by colour and genitalic differences but the rest of the morphology is similar. *N. betousalis* is unusual amongst the African Thyrididae in having such strong sexual dimorphism of colour and pattern. In spite of widespread collecting no specimens have been taken outside Kenya. Until more males are collected, there is a small element of doubt of the correctness of the association of the males and females of this species.

DISTRIBUTION. Map 69. Kenya.

MATERIAL EXAMINED.

Holotype ♀ (*betousalis*), KENYA: Kibwezi (*Scheffler*), BM slide no. 9703, in ZMB. LECTOTYPE ♀ (*bryaxis*), here designated, KENYA: B.E. Africa, Kedai, 26.xi.1911

(*Feather*), *Rhodoneura bryaxis* Fawcett, cotype, BM slide no. 13138, in BMNH (no male specimens in original series).

Other material. KENYA: 1 ♀, Kedai, 12.iii.1912 (*Feather*), (paralectotype); 1 ♀, Kedai, 26.xii.1912 (*Feather*); 2 ♀, Masongaleni, 25.xii.1911 (*Feather*); 3 ♀, Voi, xi.1951 (*Sheldrick*), in NMK; 8 ♀, Kibwezi, 20.xii. (*Feather*); 4 ♀, Kibwezi, 21.xii.1916 (*Feather*); 2 ♀, Kibwezi, 18.xii.1916 (*Feather*); 3 ♀, Kibwezi, 14.i.1917 (*Feather*); 1 ♂, Kibwezi, 22.xii.1918 (*Feather*); 1 ♂, Kibwezi, 29.iv.1919 (*Feather*); 1 ♀, Kibwezi, xii.1927 (*Feather*); 2 ♀, Nairobi, iv.1930 (*van Someren*); 1 ♀, Sokoke Forest, Kilifi, ix.1965 (*Duff-Mackay*), in NMK.

SIJUA gen. n.

Type-species, *Sijua parvula* sp. n.

This genus contains nine similarly patterned species and one species which is only tentatively placed in this genus. Most of the species in the genus have pale, sandy brown wings with a very similar pattern. The males of the genus can be separated from all other African species by the Y-shaped tergal sclerite (see later). Occasionally this Y-shaped sclerite is closed at the top. Morphologically this genus is similar to *Nemea* Whalley but this genus lacks the Y-shaped sclerite and generally has a more enlarged gnathus. At present species of the genus *Sijua* are only known from Africa where it is found mainly in West Africa, with the exception of *S. meriani*. This latter species is from the Seychelles and only one badly damaged specimen is known.

GENERIC DESCRIPTION. Antennae minutely ciliate. Labial palps 3-segmented. Eyes without interfacetal hairs. Proboscis present. Fore wing with radial veins from cell. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Tarsi without spines. Valve of male genitalia simple. Gnathus present. Prominent Y-shaped sclerite on tergum of IXth segment of male. Female usually with minute spines over bursa, sometimes with small patches of spines grouped together. Duct of bursa minutely spined.

BIOLOGY. No information.

KEY TO THE MALES OF THE AFRICAN SPECIES OF *SIJUA*

1		Prominent hind wing fascia, either complete or made up of spots, usually brown edged with varying width of white	2
–		Hind wings without prominent fascia	4
2	(1)	Fore wing with broad white fascia, wing colour mostly white, median hind wing fascia consisting of black spots	***neolatizona*** (p. 161)
–		Fore wing without conspicuous fascia. Colour of fore wing sandy brown or grey	3
3	(2)	Small species, wing under 11 mm. Grey fore wings, hind wing fascia narrow. Black spot in fore and hind wing. Terminal margin of hind wing incised below apex	***canitia*** (p. 163)
–		Larger species, wing over 11 mm. Brown or yellow-brown fore wing. Hind wing fascia broad. Black spot on hind wing only. Terminal margin of hind wing not incised below apex	***latizonalis*** (p. 162)
4	(1)	Gnathus long, 3 × or more as long as wide	5
–		Gnathus short, less than 2 × as long as wide	6
5	(4)	Prominent white apical mark on fore wing, edged with brown. Basal process of valve upturned	***furcatula*** (p. 159)

– Apical patch in fore wing not conspicuous. Basal process on valve not strongly upturned . . . . ***sigillata*** (p. 156)

6 (4) Wing 8·5 mm or under. Conspicuous white apical patch on fore wing ***parvula*** (p. 160) (*meriani*, p. 160, may come out here

– Wing over 8·5 mm. Apical patch of fore wing inconspicuous . . . 7

7 (6) Several conspicuous spots on inner margin of hind wing. Genitalia as in Pl. 43, fig. 245 . . . . ***plagalis*** (p. 157)

– One or no black spots on inner margin of hind wing. Genitalia not as above . 8

8 (7) Usually without black spot on inner margin of hind wing. Dark brown species. Seychelles . . . . ***meriani*** (p. 160)

– With or without black spot on hind wing margin. African 9

9 (8) Usually one black spot on inner margin of hind wing. Saccus rounded. Genitalia as in Pl. 43, fig. 246. . . . . ***flavula*** (p. 158)

– Usually without black spot on inner margin of hind wing. Saccus rather elongate. Genitalia as in Pl. 43, fig. 243 . . . . ***jejunalis*** (p. 155)

Key to the Females of the African Species of *SIJUA*

1 Definite groups of spines in bursa forming small signa 2

– No such groups of spines 7

2 (1) Hind wing with prominent white fascia, with median fascia of brown or black spots 3

– Hind wings without prominent fascia 4

3 (2) Hind wing with median fascia mostly black spots, fore wing mostly white ***neolatizona*** (p. 161)

– Hind wing with median fascia mostly brown spots. Fore wings sandy brown colour . . . . ***latizonalis*** (p. 162)

4 (2) Small species, wing under 8·5 mm. Prominent white apical mark on fore wing. Spines in bursa groups near opening to duct into bursa . . ***parvula*** (p. 160)

– Larger species, wing over 8·5 mm. No white apical marks on fore wing . . 5

5 (4) Usually one or more black spots on inner margin of hind wing. Small patches of spines in bursa 6

– No conspicuous spots on inner margin of hind wing. Usually three or more patches of spines in bursa . . . . ***jejunalis*** (p. 155)

6 (5) Many black spots on inner margin of hind wing. Usually three patches of spines in bursa . . . . ***flavula*** (p. 158)

– One or two black spots on inner margin of hind wing. Usually two rather loose patches of spines in bursa . . . . ***plagalis*** (p. 157)

7 (1) Wing under 11 mm. Terminal margin of hind wing strongly incised below apex ***canitia*** (p. 163)

– Wing over 11 mm. Terminal margin of hind wing not or only slightly incised below apex 8

8 (7) Prominent lunule at apex of fore wing edged with black. Genitalia as in Pl. 65, fig. 414 . . . . ***furcatula*** (p. 159)

– No prominent lunule. Genitalia as in Pl. 65, fig. 411 . . ***sigillata*** (p. 156)

Sijua jejunalis (Gaede) comb. n.

(Pl. 19, figs 97, 98; Pl. 43, fig. 243; Pl. 65, figs 409, 410)

Rhodoneura jejunalis Gaede, 1917 : 375.
Rhodoneura jejunalis Gaede; Gaede, 1929 : 492.

♂. Wing, 9–15 mm. Vertex white, frons white, flattened between eyes. Labial palps with third segment 1/2 length of second, upturned, reaching vertex, labial palps approximately equal

in length to diameter of eye. Thorax white. Hind tibia with outer spur of distal pair slightly more than 1/2 length of inner spur. Proximal spurs long, inner proximal spur of hind tibia longer than inner distal spur. Inner spur of distal pair equal in length to 1st hind tarsal segment. Fore wing, pattern as in Pl. 19, fig. 97, white with pale yellow-brown markings. Black spot at apex of cell and group of black spots between veins at apex. Veins yellowish. Hind wing, pattern and colour as fore wing. Underside, paler with strongly iridescent costal fold, costal margin darker (Pl. 19, fig. 98). Fringe of fore wing and hind wing yellowish.

GENITALIA ♂ (Pl. 43, fig. 243). Saccus elongate. Anterior lobes of juxta with hairs, posterior lobes sclerotized with many short spines. Basal process of valve lightly sclerotized, dorsal part covered with spines. Gnathus weakly sclerotized. Aedeagus with lightly spined manica and a group of short, stout, spines in vesica.

♀. Wing, 10–13·5 mm. Colour and pattern as male. Labial palps reaching slightly above vertex.

GENITALIA ♀ (Pl. 65, figs 409, 410). Neck of duct lightly sclerotized. Whole length of duct and bursa covered with minute plate-like spines. Tendency to have two distinct spine patches and several smaller ones on bursa.

DISCUSSION. The intensity of pattern varies between specimens and there is some variation in the male and female genitalia. In the female the amount of sclerotization, producing small signa in the bursa, varies considerably between specimens. The scattered nature of the signa in the female and, in the male, the shape of the basal process of the valve, the spines in the vesica and the shape of the juxta separate this species from the others in the genus. This species is distributed throughout west and central Africa and in Uganda.

DISTRIBUTION. Map 64. Sierra Leone; Ivory Coast; Ghana; Togo; Nigeria; Cameroon; Gabon; Democratic Republic of the Congo; Uganda.

MATERIAL EXAMINED.

Holotype ♂, TOGO: Bismarkburg, BM slide no. 9704, in ZMB.

SIERRA LEONE: 1 ♂, Moyamba, ii.1906 (*Dudgeon*); 1 ♂, 1 ♀, Moyamba, Masim, xi.1901 (*Cator*); 2 ♂, Bo, v.1967 (*Revell*); IVORY COAST: 3 ♂, 4 ♀, Bingerville, vii–x.1915 (*Melou*); GHANA: 1 ♀, Kumasi (*Sanders*); NIGERIA: 1 ♀, Ilesha (*Humfrey*); 1♀, Ibadan, x.1913 (*Lamborn*); CAMEROON: 1 ♂, Efulen, xii.1922 (*Weber*), in CMP; 2 ♀, xi. (*Schwab*), in CMP; 1 ♀, Bitje, iv–v.1913; 2 ♀, Bitje Ja River, 1915; 2 ♂, 1 ♀, Bitje, Ja River, 2000 ft, dry season (*Bates*); 5 ♂, 1 ♀, Bitje, Ja River, wet season, x–xi.1912; 6 ♂, 3 ♀, Bitje, Ja River, wet season, x–xi.1913 (*Bates*); 1 ♀, Bitje, wet season, iv–v.1912; GABON: 2 ♂, Abanga R., x.1907 (*Ansorge*); DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Lusambo, x.1949 (*Fontaine*), in MRAC; 1 ♀, Lusambo, Lubefu (*Fontaine*), v.1953, in MRAC; 1 ♀, Equateur, Hoko à Gombe, v.1921 (*Verlaine*), in MRAC; 1 ♂, Arebe, W. of Lake Albert, ii; UGANDA: 1 ♂, Kayonza Kigezi, v–vi.1957 (*Jackson*), in NMK; 1 ♂, Ruwenzori Range, Semliki Forest, 2850 ft, viii–ix 1952 (*Fletcher*).

Sijua sigillata (Warren) **comb. n.**

(Pl. 19, figs 99, 100; Pl. 43, fig. 244; Pl. 65, fig. 411)

Pharambara sigillata Warren, 1898b : 223.
Rhodoneura sigillata (Warren) Dalle Torre, 1914 : 33.
Rhodoneura sigillata (Warren); Gaede, 1917 : 365.
Rhodoneura sigillata (Warren); Gaede, 1929 : 492.

♂. Wing, 11–13 mm. Vertex whitish brown, frons similar. Labial palps with third segment 1/2 length of second, upturned, just reaching vertex. Thorax pale whitish brown. Hind tibia with outer spur of distal pair 1/2 length of inner spur; inner spur slightly less than length of 1st hind tarsal segment. Proximal spurs of hind tibia with inner spur longer than inner spur of distal pair. Fore wing, pattern as in Pl. 19, fig. 99, whitish with pale grey-brown markings. Dark spot in cell, several dark spots in between veins subterminally Underside darker than upperside. Costal margin brown. Iridescent scales in line subcostally (Pl. 19, fig. 100). Hind wing, colour and pattern as fore wing, black spot in centre of wing smaller than fore wing black spot. No iridescent scales on underside. $Sc+R_1$ and Rs approach closely but do not join.

GENITALIA ♂ (Pl. 43, fig. 244). Median basal process with lateral toothing.

♀. Wing, 13–14 mm. Colour and pattern as in male. Labial palps reaching slightly above vertex.

GENITALIA ♀ (Pl. 65, fig. 411). No signum in bursa although traces of minute sclerotizations found in one specimen from the Ivory Coast.

DISCUSSION. The shape of the median basal process in the male and the lack of the signum in the female are the characters separating this species from *S. plagalis* Gaede. Externally *S. plagalis* has more black spots, particularly on the hind wing, but otherwise these two species are very similar and may be forms of a single species. No intermediates have been found between these two species in the specimens examined.

DISTRIBUTION. Map 65. Ivory Coast; Nigeria.

MATERIAL EXAMINED.

Holotype ♂, NIGERIA: Warri, ix.[18]97 (*Roth*), BM slide no. 9607, in BMNH.

NIGERIA: 1 ♂, data as type; 1 ♀, Warri, Niger, CP., v.1897 (*Roth*); 2 ♀, Degama, Niger, CP (*Ansorge*), iv.1902; 1 ♀, Ogruga, Niger; 1 ♂, U.C. Ibadan, v.1958 (*Sutton*); IVORY COAST: 1 ♂, 5 ♀, Bingerville, vi–x.1915 (*Melou*).

Sijua plagalis (Gaede) **comb. n.**

(Pl. 19, figs 101, 102; Pl. 43, fig. 245; Pl. 65, fig. 412)

Rhodoneura plagalis Gaede, 1917 : 376.
Rhodoneura plagialis [sic] Gaede; Gaede, 1929 : 492.

♂. Wing, 12–14 mm. Vertex whitish, frons flattened between eyes, whitish. Labial palps with third segment 1/3 length of second, upturned, reaching vertex. Thorax whitish. Hind tibia with outer spur of distal pair less than 1/2 length of inner spur. Inner spur of distal pair almost as long as first hind tarsal segment. Proximal and distal pair of spurs similar in length. Fore wing, pattern as in Pl. 19, fig. 101, whitish, patterned with grey, black discal spot, black spots between veins subapically. Black discal spot and hind (median) margin spots often enlarged. Underside brownish with pattern well marked. Iridescent scales under costal margin (Pl. 19, fig. 102). Hind wing, colour and pattern as fore wing. Large black spots, often rather square in shape, in median position near hind margin. These black spots are variable in number, frequently four or more, sometimes only one. $Sc+R_1$ approaching Rs but not joining.

GENITALIA ♂ (Pl. 43, fig. 245). Small cornuti in aedeagus.

♀. Wing, 13·5–15 mm. Colour and pattern as male.

GENITALIA ♀ (Pl. 65, fig. 412). Signum usually double, sometimes smaller sclerotization in bursa but not as many as in *S. jejunalis* Pag.

DISCUSSION. This species is similar to *sigillata* and *jejunalis*. From the former it can be separated as given in the discussion under *sigillata*, and from *jejunalis* by the more conspicuous spots on the hind margin of the hind wing of *plagalis*. In the genitalia the shape of the median basal process of the male and the twin signa of the female separate this species from the others in the genus.

DISTRIBUTION. Map 65. Ivory Coast; Nigeria; Cameroon; Gabon; Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♀, CAMEROON: Eldea, BM slide no. 9714, in ZMB.

IVORY COAST: 16 ♂, 7 ♀, Bingerville, vi–x.1915 (*Melou*); NIGERIA: 1 ♀, R. Niger, Sapele (*Sampson*); 1 ♀, Old Calabar (*Crompton*); 1 ♀, Lagos (*Strachan*); CAMEROON: 3 ♂, 8 ♀, Efulen, 1921–23 (*Weber*), two ♂, six ♀ in CMP; GABON: 1 ♂, Belinga, 600 m, camp centrale, iii.1962 (*Bernardi*), in MNHN; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♀, Lusambo, xi.1949 (*Fontaine*), in MRAC; 2 ♀, Sankuru, Katako Kombe, i–v.1953 (*Fontaine*), one ♀ in MRAC.

Sijua flavula (Pagenstecher) **comb. n.**

(Pl. 20, fig. 103; Pl. 43, fig. 246; Pl. 65, fig. 413)

Siculodes flavula Pagenstecher, 1892 : 111.
Rhodoneura flavula (Pagenstecher) Hampson, 1897 : 621.
Rhodoneura flavula (Pagenstecher); Dalle Torre, 1914 : 23.
Rhodoneura flavula (Pagenstecher); Gaede, 1917 : 368.
Rhodoneura flavula (Pagenstecher); Gaede, 1929 : 492.

♂. Wing, 12–14 mm. Vertex whitish brown, frons pale brown. Labial palps with third segment 1/2 length of second, upturned, reaching vertex. Thorax whitish brown. Hind tibia with outer spur of distal pair 1/2 length of inner spur; inner spur of distal pair almost as long as 1st hind tarsal segment. Distal and proximal spurs similar in length. Fore wing, pattern as in Pl. 20, fig. 103, whitish with pale grey markings. Prominent black discal spot. Apex and terminal margin with black spots between veins. Veins yellowish. Underside greyer, pattern darker. Discal spot prominent, iridescent scales in line subcostally. Hind wing, similar colour and pattern as fore wing, black, usually double, mark on median hind margin. Underside, as underside of fore wing but without iridescence. $Sc+R_1$ approach but do not join.

GENITALIA ♂ (Pl. 43, fig. 246). Median basal process reaches almost to hind margin of valve.

♀. Wing, 16–17 mm. Colour and pattern as male. Labial palps reaching above vertex.

GENITALIA ♀ (Pl. 65, fig. 413). Signum generally triple, occasionally with small additional patch.

DISCUSSION. The type-specimen of this species is a female and I am uncertain whether the males described above are correctly associated. Externally they appear similar to the females. This species is generally larger than the others in the genus.

DISTRIBUTION. Map 66. Nigeria; Cameroon; Gabon; Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♀, GABON: Mocquerys, 1890 (*Staudinger*), BM slide no. 9716, in ZMB.

NIGERIA: 1 ♀, Ilesha (*Humfrey*); CAMEROON: 2 ♀, Efulen, xi.1921–ii.1922 (*Weber*), one ♀ in CMP; 1 ♀, Lolodorf (*Condradt*), 1894–95; GABON: 2 ♂, Belinga, 900 m, N.

Créte, Sud., iii.1963 (*Bernardi*), one ♂ in MNHN; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♀, Eala, ii.1936 (*Ghésquière*), in MRAC; 1 ♀, Sankuru, Katako Kombe, xii.1952 (*Fontaine*), in MRAC.

Sijua furcatula (Pagenstecher) **comb. n.**

(Pl. 20, fig. 104; Pl. 44, fig. 247; Pl. 65, fig. 414)

Siculodes furcatula Pagenstecher, 1892 : 71.
[*Rhodoneura bastialis* sensu Hampson, 1897 : 624; nec Walker.]
[*Rhodoneura bastialis* sensu Dalle Torre, 1914 : 20; nec Walker.]
Rhodoneura furcatula (Pagenstecher) Gaede, 1917 : 368.
[*Rhodoneura bastialis* sensu Gaede, 1929 : 494; nec Walker.]

♂. Wing, 11–12 mm. Vertex white, frons white, flattened between eyes. Labial palps with third segment 1/2 length of second, upturned, reaching vertex. Patagia and prothorax dark brown, rest of thorax whitish. Hind tibia with outer spur of distal pair less than 1/2 length of inner; inner spur of distal pair almost as long as 1st hind tarsal segment. Inner spur of proximal pair more slender than distal and longer than corresponding distal spur. Fore wing, pattern as in Pl. 20, fig. 104, yellowish white with grey reticulations. Costal margin dark, continuous with patagia and dark prothoracic line. Apex of wing white with black spots between veins, this white area strongly bordered on inner margin by grey. Grey median fascia, narrow at centre of wing. Underside, similar to upper, slight reddish tinge over wing. Strongly iridescent scales along central costal margin under fore wing. Hind wing, similar colour to fore wing, some black marks on hind wing margin. Underside similar to upperside. $Sc+R_1$ approaches Rs but does not join.

GENITALIA ♂ (Pl. 44, fig. 247). Gnathus lightly sclerotized. Small, strongly sclerotized, tooth on median basal process of valve. Last abdominal segment with posterior margin of sternum strongly concave. Aedeagus with manica lightly spined. No cornuti.

♀. Wing, 11·5–12·5 mm. Similar to male but third segment of labial palp 1/2 length of second.

GENITALIA ♀ (Pl. 65, fig. 414). Duct long, slender and covered with minute sclerotized plates. Bursa minutely spined, no signum.

DISCUSSION. This species has generally been regarded as conspecific with *R. bastialis* Walker. However, apart from some external differences, *bastialis* has a median basal process covered in short teeth and there are numerous cornuti in the aedeagus. The female of *bastialis* also has two strong signa in the bursa. The holotype of *S. furcatula* Pag., which was seen by Gaede in 1917, has been lost (H. Hannemann, personal communication). I am therefore designating for this species a neotype which agrees with the description and figure of Pagenstecher. This specimen, although a Carnegie Museum specimen, is deposited in the Zoological Museum, Berlin where Pagenstecher's type was originally deposited. This is possible because of the generous permission of the Carnegie Museum Authorities.

DISTRIBUTION. Map 67. Ivory Coast; Nigeria; Cameroon.

MATERIAL EXAMINED.

Holotype ♀, lost. NEOTYPE ♀, here designated, CAMEROON: Efulen, 14.iv.1923 (*Weber*), BM slide no. 10276, in ZMB.

IVORY COAST: 1 ♂, Forêt du Banco, x.1963 (*Piart & Griveaud*), in MNHN; NIGERIA: 1 ♀, Warri, ix.1897 (*Roth*); CAMEROON: 1 ♂, Bitje, Ja River, 2000 ft, x–xi.1912; 11 ♂, 1 ♀, Efulen, 1912–23 (*Weber*), nine ♂, one ♀ in CMP; 1 ♀ (*Schwab*).

Sijua parvula **sp. n.**

(Pl. 20, fig. 105; Pl. 44, fig. 248; Pl. 65, fig. 415)

♂. Wing, 7·5–8·5 mm. Vertex pale brown, frons similar, flattened between eyes. Labial palps with third segment 1/2 length of second, upturned, reaching vertex. Thorax brown. Hind tibia with outer spur of distal pair 1/2 length of inner; inner spur of distal pair as long as 1st hind tarsal segment. Fore wing, pattern as in Pl. 20, fig. 105, brown, apex white with several black spots between veins. Small black discal spot, some darker transverse marks, reticulations obscure. Underside paler than upperside, white apical mark conspicuous. Iridescent scales along costal margin under fore wing. Hind wing, colour and pattern as fore wing, darker transverse fascia clearer than fore wing. Black spots on hind wing margin.

GENITALIA ♂ (Pl. 44, fig. 248). Median basal process produced beyond margin of valve. No cornuti in aedeagus.

♀. Wing, 8·5–9·5 mm. Similar to male but generally darker and often with dark costal margin and grey (rather than white) apical patch. Underside with reddish tinge.

GENITALIA ♀ (Pl. 65, fig. 415). Duct of bursa covered with minute sclerotized plate-like spines. Bursa minutely spinose, no signum.

DISCUSSION. This species is structurally similar to *S. furcatula* Pag. and *S. meriani* Gaede. *S. parvula* can be separated from *furcatula* by its smaller size and by the shape of the basal process of the valve of the male. From others in the genus the small size of *parvula* readily separates it. The relationship between *parvula* and *meriani* is not clear. At present *meriani* is only known from the badly damaged holotype from the Seychelles but there are small differences between this and *parvula*. The costal margin of the fore wing is more sinuous in *parvula* than in the other species of the genus.

DISTRIBUTION. Map 66. Ivory Coast; Cameroon.

MATERIAL EXAMINED.

Holotype ♂, IVORY COAST: Bingerville, 8–11.ix.1915 (*Melou*), BM slide no. 10273, in BMNH.

Paratypes: IVORY COAST: 7 ♂, 68 ♀, data as type.

Material not included in the type-series. CAMEROON: 1 ♂ (*Sjöstedt*), in NR.

Sijua meriani (Gaede) **comb. n.**

(Pl. 20, fig. 105a)

Rhodoneura meriani Gaede, 1917 : 376.
Rhodoneura meriani Gaede; Gaede, 1929 : 492.

♂. Wing, 8·5 mm. Head badly damaged. Antennae minutely ciliate. Proboscis present. Labial palps broken. Fore wing, pattern as Pl. 20, fig. 105a, grey-brown with purplish tinge. Underside with more distinct pattern. Apical white triangular patch with black spots between veins. Median and basal reddish brown patches. Black scales in cell and along some veins. Iridescent scales numerous on underside. Hind wings badly damaged. Abdomen missing.

♀. Unknown.

DISCUSSION. This specimen is badly damaged but it should be possible to match it when other specimens are available from the Seychelles. From the fore wing pattern, *S. meriani* is closely related to *S. parvula*. At present, *parvula* is known only from West Africa but there is a general similarity to the Seychelles specimen

of *meriani*. The differences between the two species are mainly in the more obscure fore wing pattern of *meriani* where the apical marks are indistinct on the upper side. The undersides are similar but the specimen of *meriani* is a darker brown than *parvula*. Both species have black scales in the cell and have iridescent scales under the fore wing. Until more specimens of *meriani* are available the relationship between this and *parvula* is not clear.

DISTRIBUTION. Map 66. Seychelles.

MATERIAL EXAMINED.

Holotype ♂, SEYCHELLES: Mahé (*Merian*), in ZMB.

Sijua neolatizona sp. n.

(Pl. 20, fig. 106; Pl. 44, fig. 249; Pl. 65, figs 416, 417)

♂. Wing, 10·5–11·5 mm. Vertex white, frons brown, flattened between eyes. Labial palps with third segment 1/2 length of second, upturned, reaching vertex. Thorax white. Hind tibia with outer spur of distal pair 1/2 length of inner spur. Inner spur of distal pair shorter than 1st hind tarsal segment. Proximal pair with inner spur longer and more slender than corresponding distal spur. Fore wing, pattern as in Pl. 20, fig. 106, white with yellowish markings, some black in median area. Apical white area with black spots between veins, bordered by darker curved line. Costal margin yellow at base. Underside with more prominent pattern. Line of iridescent scales under fore wing in subcostal position. Hind wing, white, prominent median fascia of black and yellow spots. Terminal and subterminal area with yellowish and white patches. Subterminal line double row of black spots. $Sc+R_1$ and Rs approach closely but not joining.

GENITALIA ♂ (Pl. 44, fig. 249). Apex of median basal process with sclerotized point. Vesica with small spines.

♀. Wing, 11·5–12·5 mm. Colour and pattern as male.

GENITALIA ♀ (Pl. 65, figs 416, 417). Duct of bursa covered with small sclerotized plate-like spines. Bursa minutely spinose, no signum.

DISCUSSION. The pattern of this species varies considerably, some specimens are more heavily patterned than others and the amount of yellow on the terminal and subterminal areas varies considerably. The hind wing has a similar pattern to *latizonalis* Hampson to which this species is closely allied. It can be distinguished externally from *latizonalis* by the colour of the fore wing (white in *neolatizona*; pale brown in *latizonalis*). In the male genitalia the shape of the median basal process is distinctive. In *latizonalis* the process is broad and rounded, in *neolatizona* it is more angular and saggitate. The manica of the aedeagus is spiny in *latizonalis* but smooth in *neolatizona*. Both species have spines round the ostium but the duct of *latizonalis* is broader and shorter than *neolatizona*.

DISTRIBUTION. Map 68. Liberia; Ivory Coast; Cameroon; Democratic Republic of the Congo; Uganda; Kenya.

MATERIAL EXAMINED.

Holotype ♂, CAMEROON: Bitje, Ja River, 2000 ft, dry season (*Bates*), BM slide no. 9951, in BMNH.

Paratypes. LIBERIA: 1 ♂, Nimba, Grassfield, ii.1968 (*Forbes-Watson*); IVORY COAST: 1 ♂, Bingerville, 1915 (*Melou*); CAMEROON: 1 ♂, data as type; 1 ♀, Bitje,

Ja River, 2000 ft, x–xi.1912; 1 ♂, Efulen (*Weber*), iv.1923, in CMP; GABON: 1 ♀, Kangwe, Ogové R. (*Good*); 1 ♀, Kangwe, in CMP; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Lulua, Kapanga, iii.1933 (*Overlaet*), in MRAC; 1 ♂, Kafakumba, xi.1934 (*Overlaet*), in MRAC; UGANDA: 1 ♀, Fort Portal, v.1958 (*Carcasson*), in NMK; KENYA: 1 ♂, Malowa Forest, Kabras, v.1952 (*Pinhey*).

Sijua latizonalis (Hampson) **comb. n.**

(Pl. 20, fig. 108; Pl. 44, fig. 250; Pl. 65, figs 418, 419)

Rhodoneura latizonalis Hampson, 1897 : 622.
Banisia albisignata Warren, 1899a : 4, **syn. n.**
Rhodoneura latizonalis Hampson; Dalle Torre, 1914 : 25.
Rhodoneura albisignata (Warren) Dalle Torre, 1914 : 18.
Rhodoneura latizonalis Hampson; Gaede, 1917 : 365.
Rhodoneura albisignata (Warren); Gaede, 1917 : 365.
Rhodoneura latizonalis Hampson; Gaede, 1929 : 493.
Rhodoneura albisignata (Warren); Gaede, 1929 : 493.

♂. Wing, 11–13 mm. Vertex pale brown, irrorate with white. Frons brown, flattened between eyes. Labial palps with third segment 1/3 length of second, upturned, just reaching vertex. Thorax pale brown, irrorate with white. Outer spur of distal pair of hind tibia 1/2 length of inner spur; inner spur almost as long as 1st hind tarsal segment. Inner proximal spur thinner than inner distal spur, but equal in length. Fore wing, pattern as in Pl. 20, fig. 108, pale grey-brown, black discal spot, black spots on costal margin, white apical area with black spots. Underside paler than upper, white apical area with black spots conspicuous. Iridescent scales in line subcostally. Hind wing, terminal and subterminal margins pale grey-brown. Median fascia made up of spots of yellow scales surrounded by black. Basal area similar, on either side of median fascia a broad band of white. Underside with median fascia usually absent and whole area white. $Sc+R_1$ and Rs approach but do not join.

GENITALIA ♂ (Pl. 44, fig. 250). Median basal process well sclerotized. Cornuti absent.

♀. Wing, 12–13·5 mm. Colour and pattern as male. Third segment of labial palp 1/2 length of second.

GENITALIA ♀ (Pl. 65, figs 418, 419). Ostium with spiny pads on each side. Duct covered with small plate-like spines. Bursa minutely spined, no signum.

DISCUSSION. This species is easily recognized by the two white fascia on the hind wing and the rather faintly marked pale brown fore wing. The male genitalia are very distinctive. The structure of the bursa is characteristic of the genus but the shape of the ostium differentiates *latizonalis* from the other species.

DISTRIBUTION. Map 68. Sierra Leone; Liberia; Ghana; Nigeria; Cameroon; Democratic Republic of the Congo.

MATERIAL EXAMINED.

LECTOTYPE ♂ (*latizonalis*), here designated, SIERRA LEONE: 19.iv.[18]95, *Rhodoneura latizonalis* Hampson, type, BM slide no. 9608, in BMNH. Holotype ♀ (*albisignata*), NIGERIA: Warri, vi.[18]97 (*Roth*), BM slide no. 9609, in BMNH.

SIERRA LEONE: 1 ♀, vii.1896 (paralectotype); 1 ♂, v.1895 (*Clements*) (paralectotype); 1 ♂, 3 ♀, Bo, vi–xi.1967 (*Revell*); 1 ♂, 1 ♀, Bo, i–iii.1969 (*Revell*); 1 ♀ (no other data); LIBERIA: 1 ♂, 10 ml., E. Monrovia, below 100 ft, start of rains, v.1926 (*Portal-Hyatt*); GHANA: 1 ♀, Coomassie [Kumasi] (*Whiteside*); NIGERIA: 1 ♀, Agbaja,

Ko Prov., N. Nigeria, viii–ix.1913 (*Cator*); 1 ♀, U.C. Ibadan, v.1958 (*Sutton*); 1 ♀, Ikom, iii.1930; CAMEROON: 3 ♂, 3 ♀, Bitje, Ja River, 2000 ft, ix–xi.1912; 1 ♂, 1 ♀, Bitje, Ja River, 2000 ft, dry season, vi–vii.1909 (*Bates*); 1 ♂, Bitje, Ja River, x., wet season (*Bates*); 1 ♀, Bitje, 3°N, 12°E., wet season, 1926 (*Bates*); DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♀, Bupoto, Upper Congo, vi.1901 (*Smith*), 1 ♀, no locality data.

Sijua canitia sp. n.

(Pl. 20, fig. 107; Pl. 44, fig. 251; Pl. 66, figs 420, 421)

♂. Wing, 9–9·5 mm. Vertex grey with white scales. Frons mostly white. Labial palps long, 2 × diameter of eye, upturned, reaching vertex, third segment 1/2 length of second. Patagia white, rest of thorax grey-white. Hind tibia with inner spur of proximal pair long, reaching almost to tip of longest distal spur. Fore wing, pattern as in Pl. 20, fig. 107, grey with black spot at apex of cell and a small creamy white area subapically. Indistinct darker transverse fascia. Underside strongly patterned with white marks terminally between $1A$ and M_3 and M_3, M_2 and M_1. Black and silver iridescent scales in cell. White patch stretching from apex towards posterior median area, reaching backwards to M_2. Hind wing, more patterned than fore wing with ante- and post-median light-coloured fascia. Prominent black spot in cell. Hind wing incised below apex. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 44, fig. 251). Uncus simple. Gnathus weakly sclerotized with small median projection. Valve with sclerotized basal process with hairy pad behind process towards mid-line. Juxta two, simple, rounded lobes. Saccus rather elongate. Valve narrowing in terminal half. Aedeagus with sclerotized rod on one side, vesica strongly toothed.

♀. Wing, 9·8 mm. Pattern as in male, slightly darker grey-brown than male.

GENITALIA ♀ (Pl. 66, figs 420, 421). Anal papillae short. Ostium lightly sclerotized and spined, duct with narrow and short sclerotized portion, rest of duct long and slender. Bursa without signum.

DISCUSSION. The pattern and wing shape of this species are rather similar to *C. nigropunctulus* Pag. but the genitalia are quite distinct. The male has the "Y"-shaped sclerite on the tergum of the IXth segment characteristic of the genus *Sijua* but the wing shape is atypical. The female lacks the spines in the bursa found in the other species of the genus. I am therefore placing this species only tentatively in this genus.

DISTRIBUTION. Map 67. Ivory Coast; Cameroon; Gabon; Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♂, CAMEROON: Efulen, 19.iii.1914 (*Weber*), BM slide no. 10363, in CMP.

Paratypes. IVORY COAST: 1 ♀, Bingerville, ix.1915 (*Melou*); GABON: 1 ♂, Kangwe; DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Bolobo-Eala, 1921 (*Verlaine*), in MRAC (this specimen lacks the abdomen).

OPULA Walker

Opula Walker, 1869 : 371. Type-species, *O. impletalis* Walker, by monotypy.
Opula Walker; Dalle Torre, 1914 : 17.
Opula Walker; Whalley, 1964a : 123.
Opula Walker; Whalley, 1967 : 39.
[*Rhodoneura* sensu auct., nec Guenée.]

This genus contains six species in Africa. *Opula* Walker has, until recently, been regarded as a junior synonym of *Rhodoneura* Guenée. As a result it is possible that there are species from the Oriental region, at present in the genus *Rhodoneura*, which should be transferred to *Opula*. Species of the genus *Opula* can be distinguished from *Rhodoneura* by the absence of spines on the tarsal segments, these are present in *Rhodoneura*. The two species of the genus known from Madagascar (*O. chopardi* Viette and *O. lineata* Whalley) differ slightly from the African species in the shape of the female genitalia. It is possible that the Madagascan species should be placed in a separate subgenus but this will have to wait for the collection and study of more material.

The genus *Opula* is known only from Africa and Madagascar. It shows some similarities with *Sijua* Whalley, differing primarily in the development of the signum in the females. The African species of *Opula* all look rather similar and have a mostly West African distribution.

GENERIC DESCRIPTION. Labial palps 3-segmented. Proboscis present. Eyes without interfacetal hairs. Fore wing with radial veins from cell. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Tarsal segments without spines. Male with a simple uncus. Gnathus present. Juxta usually with incurved apices to the lateral lobes. Female with prominent spiny signum in bursa.

BIOLOGY. Larvae of *O. spilotata* have been bred from leaves of rice in Nigeria.

KEY TO THE AFRICAN SPECIES OF *OPULA*

1		Wing over 20 mm	2
–		Wing under 20 mm	3
2	(1)	Prominent black spot over apex of cell of fore wing . .	***monsterosa*** (p. 169)
–		No black spot on fore wing	***hebes*** (p. 168)
3	(1)	Black spots on fore wing subapically, often a row of black spots subterminally. Male with strong hooked median basal process on valve. Female with transverse signum in anterior third of bursa nearer duct . .	***spilotata*** (p. 166)
–		No black spots in fore wing. Median basal process not hooked. Signum transverse or oblique near middle of bursa	4
4	(3)	Hind wings lighter coloured than fore wing, less heavily patterned	***scardialis*** (p. 167)
–		Fore and hind wings similarly coloured	5
5	(4)	Over 13 mm wing. Edges of valve of male roughly parallel. Female with strong transverse signum in posterior 1/3 of bursa . .	***impletalis*** (p. 164)
–		Wing less than 13 mm. Male with valve narrowing towards apex. Female with oblique signum	***perigrapha*** (p. 165)

Opula impletalis Walker

(Pl. 21, fig. 109; Pl. 45, fig. 253; Pl. 66, figs 422, 423)

Opula impletalis Walker, 1869 : 371.
Rhodoneura impletalis (Walker) Hampson, 1897 : 618.
Rhodoneura micragraphalis Hampson, 1897 : 619, **syn. n.**
Rhodoneura impletalis (Walker); Dalle Torre, 1914 : 25.
Rhodoneura micragraphalis Hampson; Dalle Torre, 1914 : 26.
Rhodoneura impletalis (Walker); Gaede, 1917 : 364.
Rhodoneura micragraphalis Hampson; Gaede, 1917 : 364.

Rhodoneura impletalis (Walker); Gaede, 1929 : 492.
Rhodoneura micragraphalis Hampson; Gaede, 1929 : 492.
Opula impletalis Walker; Whalley, 1964a : 123.
Opula impletalis Walker; Whalley, 1967 : 39.

♂. Wing, 13–16 mm. Vertex brown with white scales in centre produced into tuft between antennae. Frons brown, not swollen. Antennae minutely ciliate. Labial palps with third segment 1/3 length of second, upturned, reaching vertex. Thorax brown, irrorate with white. Hind tibia with outer spur of distal pair 1/2 length of inner spur, almost as long as 1st segment of hind tarsi. Fore wing, pattern as in Pl. 21, fig. 109, brown with grey-brown markings. Underside of wing paler than upperside. Hind wing, colour and pattern as fore wing. Vein $Sc+R_1$ and *Rs* free.

GENITALIA ♂ (Pl. 45, fig. 253). Gnathus lightly sclerotized. Valves narrowing near apex. Last segment of abdomen with concave posterior margin. Aedeagus with spiny manica.

♀. Wing, 18–20·5 mm. Colour and pattern as male. Third segment of labial palp 1/2 length of second.

GENITALIA ♀ (Pl. 66, figs 422, 423). Neck of bursa lightly sclerotized behind ostium. Signum variably spined, generally transverse, with some differences in size in different specimens.

DISCUSSION. The genitalia of the male and female of this species are very similar to *O. spilotata* Warren but the pattern of the two species is quite distinct. From *O. perigrapha*, which this species also resembles externally, *O. impletalis* can be separated by its larger size and heavier pattern. In the genitalia in the male, *perigrapha* has a broad gnathus while *impletalis* has a narrow one. In the female the very elongate signum of *perigrapha* easily separates this from *impletalis*.

DISTRIBUTION. Map 61. Sierra Leone; Ivory Coast; Ghana; Nigeria; Cameroon; Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♀ (*impletalis*), DEMOCRATIC REPUBLIC OF THE CONGO: 85.75, in BMNH (the specimen lacks an abdomen). LECTOTYPE ♂ (*micragraphalis*), here designated, SIERRA LEONE: 97.38, *Rhodoneura micragraphalis* Hampson, type ♂, BM slide no. 8517, in BMNH.

SIERRA LEONE: 1 ♀ (*Distant*); IVORY COAST: 1 ♂, Asorokrou, 18–20.ii.1903 (*Pemberton*); 3 ♀, Bingerville, iii.1915 (*Melou*); GHANA: 1 ♂, Coomassie [Kumasi] (*Whiteside*); NIGERIA: 1 ♀, Ibadan, viii–ix.1955 (*Alexander*); CAMEROON: 1 ♂ (no other data); 1 ♀, no locality data, in CMP.

Opula perigrapha (Hampson) **comb. n.**

(Pl. 21, fig. 110; Pl. 45, fig. 254; Pl. 66, figs 424–426)

Rhodoneura perigrapha Hampson, 1914 : 114.
Rhodoneura perigrapha Hampson; Gaede, 1917 : 365.
Banisia spilotata ab. *complicata* Warren, 1898b : 222, **syn. n.**

♂. Wing, 10·5–12 mm. Vertex pale yellow-brown, lighter in centre, produced in tuft between antennae. Frons brown, not swollen. Antennae minutely ciliate. Labial palps with third segment 1/3 length of second, upturned, not reaching vertex. Thorax pale yellow-brown. Hind tibia with outer spur of distal pair slightly more than 1/2 length of inner spur. Inner spur 2/3 length of 1st hind tarsi. Fore wing, pattern as in Pl. 21, fig. 110, pale grey-brown, reticulated with darker brown and with darker transverse fascia. Underside paler. Hind wing, pattern and colour as fore wing. $Sc+R_1$ and *Rs* free.

GENITALIA ♂ (Pl. 45, fig. 254). Median basal process on valve more slender than in other species of *Opula*. Gnathus broad, equal in width to broadest part of juxta lobes. Valves tapering. Manica minutely spined.

♀. Wing, 11·5–13 mm. Colour and pattern as male. Labial palps with third segment 1/2 length of second segment.

GENITALIA ♀ (Pl. 66, figs 424–426). Very long signum, generally somewhat longitudinally placed along bursa.

DISCUSSION. This species looks like a small pale-coloured specimen of *O. impletalis*, but in the series examined no intermediates in the size range of these two species has been found. Generally the pattern of *impletalis* is more heavily marked than *perigrapha*.

DISTRIBUTION. Map 63. Sierra Leone; Liberia; Ghana; Nigeria; Cameroon; Gabon; Democratic Republic of the Congo.

MATERIAL EXAMINED.

LECTOTYPE ♂, here designated, GHANA: Coomassie [Kumasi] (*Whiteside*), 1905–289, *Rhodoneura perigrapha* Hampson, type ♂, BM slide no. 9614, in BMNH.

SIERRA LEONE: 1 ♂, Moyamba, iii.1903 (*Cator*); LIBERIA: 1 ♂, Nimba, Grassfield, ii.1968 (*Forbes-Watson*); GHANA: 3 ♂, data as type (paralectotypes); NIGERIA: 1 ♂, Calabar, x.1960 (*Markham*), in NMK; 1 ♀, Degama, 3.iv.1902 (*Ansorge*); 2 ♀, Warri, v–vi.1897 (*Roth*), (syntypes of ab. *complicata*); 1 ♂, Warri, Niger, C. Prot., vii. 1897 (*Roth*); CAMEROON: 1 ♀, Bitje, iv–v.1913; 1 ♀, Bitje, Ja River, 1915; 1 ♀, Efulen, v.1913 (*Weber*), in CMP; GABON: 1 ♂, Belinga, 600 m, Piste de Mwadhi, iii.1963 (*Bernardi*), in MNHN; 1 ♀, Makokou, 500 m, Miss. Biolog., ii.1962 (*Bernardi*), in MNHN; DEMOCRATIC REPUBLIC OF THE CONGO: Dima-Butola, x.1921 (*Verlaine*), in MRAC; 1 ♂, Equateur, Flandria, vi.1931 (*Hulstaert*), in MRAC; 1 ♂, 1 ♀, no locality data in CMP.

Opula spilotata (Warren) comb. n.

(Pl. 21, fig. 111; Pl. 44, fig. 252; Pl. 66, figs 427–428)

Rhodoneura spilotata Warren, 1898b : 222.
[*Rhodoneura spilotata* ab. *complicata* Warren; Warren, 1898b : 222, misidentification, specimen of, *spilotata* ab. *complicata* is actually *O. perigrapha* Hampson.]
Rhodoneura miosticta Hampson, 1906 : 120, **syn. n.**
Rhodoneura spilotata Warren; Dalle Torre, 1914 : 33.
Rhodoneura miosticta Hampson; Dalle Torre, 1914 : 26.
Rhodoneura miosticta Hampson; Gaede, 1917 : 364.
Rhodoneura spilotata Warren; Gaede, 1917 : 365.
Rhodoneura miosticta Hampson; Gaede, 1929 : 492.
[*Rhodoneura spilotata* Warren ab. *complicata* Warren; Gaede, 1929 : 494, misidentification.]

♂. Wing, 10·5–15 mm. Vertex brown with white scales in centre produced in tuft between base of antennae. Frons brown, not swollen. Antennae minutely ciliate. Labial palps with third segment 1/2 length of second, upturned, reaching to or above vertex. Hind tibia with outer spur of distal pair 1/2 length of inner spur. Inner spur of distal pair almost as long as 1st tarsal segment of hind leg. Abdomen brown, median dark line on sternite, two lateral dark lines on each side of tergum. Fore wing pattern as in Pl. 21, fig. 111, brown with dark spots on subterminal fascia, subapically. These spots are usually one large and a variable number (sometimes none) small. Rest of pattern indistinct reticulations, median fascia slightly darker

than rest of wing. Hind wing, pattern and colour as fore wing. $Sc+R_1$ and *Rs* free, colour and pattern as fore wing, position of dark spots variable. Underside paler than upper, subterminal spot on fore wing very distinct.

GENITALIA ♂ (Pl. 44, fig. 252). Gnathus weakly sclerotized. Minute spines on manica of aedeagus.

♀. Wing, 12–14 mm. Third segment of labial palp over 1/2 length of second. Colour and pattern as male.

GENITALIA ♀ (Pl. 66, figs 427, 428). The spines on the signum vary in length in different specimens.

DISCUSSION. Very little variation of pattern is present although the number of black subterminal spots on the fore wing varies between specimens. The single Uganda specimen is slightly larger than the West African specimens but otherwise is similar. This species has been bred from rice in Nigeria, where it was feeding on the leaves.

DISTRIBUTION. Map 62. Guinea; Sierra Leone; Liberia; Ivory Coast; Ghana; Nigeria; Gabon; Democratic Republic of the Congo; Uganda.

MATERIAL EXAMINED.

LECTOTYPE ♀ (*spilotata*), here designated, NIGERIA: Warri, Niger (*Roth*), *Banisia spilotata* Warren, type, BM slide no. 9981, in BMNH. Holotype ♂ (*miosticta*), GHANA: Coomassie, [Kumasi] (*Whiteside*), 1905, BM slide no. 9621, in BMNH.

GUINEA: 1 ♀, Massadou, nr Macenta, 1600 ft, at light, v.1926 (*Collenette*); SIERRA LEONE: 1 ♀, Moyamba, v.1903 (*Cator*); LIBERIA: 1 ♀, Nimba, Grassfield, vi–vii.1967 (*Forbes-Watson*); IVORY COAST: 1 ♀, Bingerville, vi.1915 (*Melou*); 1 ♂, Bingerville, iii.1915 (*Melou*); GHANA: 4 ♂, Takwa (*James*); NIGERIA: 1 ♂, data as type (paralectotype); 1 ♂, Degama, Niger, C. Prot., ii.1902 (*Ansorge*); 1 ♀, Degama, Niger, vi.1902 (*Ansorge*); 1 ♂, Warri, v.1897 (*Roth*); 1 ♂, Bende, 31.viii. 1965, ex Rice; GABON: 1 ♂, 1 ♀, Ile de Lambirini, xii.1916; 1 ♂, Makokou, 500 m, Miss. Biol. iii.1962 (*Bernardi*), in MNHN; 1 ♂, Makokou, 500 m, Miss Biol. iv.1962 (*Minko*), in MNHN; 1 ♂, Belinga, 600 m, Camp Centrale, iii.1962 (*Bernardi*), in MNHN; DEMOCRATIC RRPUBLIC OF THE CONGO: 1 ♀, Upper Lowa Valley, nr Masisi, W. Kivu, 6000 ft, forest and long grass, wet season, ii.1924 (*Barns*); 1 ♂, Loile River, Ikela, Equateur, iv.1959 (*Carcasson*); 1 ♀, Sankuru, Katako Kombe, i.1952 (*Fontaine*), in MRAC; 1 ♂, Tshuapa, Bamanya, iii.1966 (*Hulstaert*), in MRAC; 1 ♀, Stan à Coq, [between Stanleyville and Coquilhatville on River Congo], xi.1921 (*Verlaine*), in MRAC; 1 ♂, Bopoto (*Kenred Smith*); UGANDA: 1 ♂, Ankole, Kalinzu Forest, xi.1961 (*Carcasson*).

Opula scardialis (Rebel) **comb. n.**

(Pl. 21, fig. 112; Pl. 45, fig. 256)

Rhodoneura scardialis Rebel, 1914 : 280.
Rhodoneura acardialis Rebel; Gaede, 1917 : 365.
Rhodoneura scardialis Rebel; Gaede, 1929 : 492.

♂. Wing, 17–18·5 mm. Vertex dark brown with scale tuft produced between antennae. Frons dark brown, not swollen. Antennae minutely pectinate. Labial palps with third segment 1/3 length of second, upturned, 1-1½ × diameter of eye. Thorax dark brown, irrorate with a few white scales. Hind tibia with outer spur of distal pair slightly more than 1/2 length of inner spur. Inner spur nearly as long as 1st tarsal segment of hind leg. Fore wing, pattern

as in Pl. 21, fig. 112, dark brown with lighter rounded areas. Costal margin dark brown. Underside similar, paler, dark brown restricted to cell and anal area. Hind wing, lighter coloured than fore wing, less dark brown, small rounded areas present, underside with a few dark spots. Veins $Sc+R_1$ and *Rs* free.

GENITALIA ♂ (Pl. 45, fig. 256). Median basal process of valve well sclerotized. Manica spined.

♀. Unknown.

DISCUSSION. The circular patches in the fore wing pattern are typical of the genus *Opula* but this species can be separated from the others in the genus by the pale coloured hind wings. No information on the biology of this species is available but from the locality data this species is forest-dwelling.

DISTRIBUTION. Map 61. Democratic Republic of the Congo; Rwanda; Tanzania.

MATERIAL EXAMINED.

Holotype ♂, TANZANIA: Ufer, NW. Tanganyika, BM slide no. 9909, in NHV.

DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Kivu, Nyamunyunye, Mulungu (*Herq*), x.1957, in MRAC; RWANDA: 1 ♂, Rugege Forest, Ruanda Distr., Lake Kivu, 8000 ft, xii.1921 (*Barns*); 1 ♂, Rugege Forest, Ruanda Distr., Lake Kivu, 7000 ft, xii.1921 (*Barns*).

Opula hebes **sp. n.**

(Pl. 21, fig. 113; Pl. 45, fig. 257)

♂. Wing, 23·5–26 mm. Vertex brown. Frons rounded, protruding in front of eyes. Antennae minutely ciliate. Labial palps with third segment 1/3 length of second, upturned, just reaching vertex. Thorax brown. Hind tibia with scale crest, outer spur of distal pair 2/3 length of inner spur, longest distal spur less than 1/2 length of 1st hind tarsal segment. Tarsi mostly without spines but one pair of spines on last tarsal segment, in front of claw. Fore wing, pattern as in Pl. 21, fig. 113, brown with darker brown reticulations. Underside similar. Hind wing, colour and pattern as fore wing. $Sc+R_1$ and *Rs* free.

GENITALIA ♂ (Pl. 45, fig. 257). Uncus slightly thickened dorso-ventrally. Gnathus with prominent median, spiny, process. Juxta with two simple lateral lobes. Basal process on valve small. Valve simple. Aedeagus with vesica covered with minute spines.

♀. Unknown.

DISCUSSION. This species is externally similar to *O. impletalis* but is much larger and has differences in the genitalia. As with *O. monsterosa*, this species is superficially similar to species of the genus *Chrysotypus* but they are morphologically quite distinct. *O. hebes* and *O. monsterosa* both occur together in the same locality in Uganda where a single specimen of each was collected in the same month. These two species can be separated from one another by the pattern and the genitalia. The female of *O. hebes* is unknown but it is interesting to speculate on the possible shape of the signum in the bursa with reference to the known species. It may be a transverse signum as in *impletalis*, which is more typical of the genus, or it may be a longitudinal signum as in *monsterosa*. The males of *hebes* and *monsterosa* are similar to one another and less like *impletalis* which suggests that the signum in the female of *hebes* should be longitudinal.

DISTRIBUTION. Map 62. Gabon; Democratic Republic of the Congo; Uganda.

MATERIAL EXAMINED.

Holotype ♂, UGANDA: Fort Portal, Mpanga Forest, v.1958 (*Carcasson*), BM slide no. 10640, in BMNH.

Paratypes. GABON: 1 ♂, Makokou, 500 m, Miss. Biologique, 7.v.1962 (*Minko*), in MNHN; DEMOCRACTIC REPUBLIC OF THE CONGO: 1 ♂, Equateur, Flandria (*Hulstaert*), 1935; 1 ♂, Luluabourg, 25.iv.1951 (*Fontaine*), in MRAC.

Opula monsterosa **sp. n.**

(Pl. 21, fig. 114; Pl. 45, fig. 258; Pl. 67, figs 429–431)

♂. Wing, 21·5–22 mm. Vertex pale brown, frons produced slightly between eyes. Antennae minutely ciliate. Labial palps with third segment 1/3 length of second, upturned. Patagia brown. Thorax paler brown. Hind tibia with outer spur of distal pair 2/3 length of inner spur. Fore wing, pattern as in Pl. 21, fig. 114, grey-brown with black spot at apex of cell. Reticulate pattern of upperside overlaid with indistinct reddish brown pattern. Underside paler. Hind wing with more distinct pattern of round spots, underside similar, colour as fore wing. Terminal margin incised below apex. $Sc+R_1$ and *Rs* free.

GENITALIA ♂ (Pl. 45, fig. 258). Uncus simple. Gnathus with prominent median process. Valve simple. Juxta, two elongate lateral lobes. Manica covered with minute spines.

♀. Wing, 27–29 mm. Colour and pattern as male.

GENITALIA ♀ (Pl. 67, figs 429–431). Anal papillae short. Ostium lightly sclerotized, then a modified, sclerotized short length of duct. Bursa with elongate spiny signum.

DISCUSSION. The relatively large size and black spot on the fore wing make this species easily recognized. This is one of the largest species in the genus, being similar in size to *O. hebes*, from which it can be separated by the black spot on the wing (absent in *O. hebes*). *O. monsterosa* is similar in size, and to some extent pattern, to *Chrysotypus phoebus* Viette from Madagascar but the two are otherwise very distinct morphologically. *O. monsterosa* differs from other species in the genus in the shape of the signum which is longitudinal in *monsterosa* but transverse in the other species. There is some variation in this character, however, in the other species and in *O. perigrapha* the signum is oblique. From *O. spilotata*, *monsterosa* can be separated by its size, by the broader valve in the male and the shape of the signum in the female. The Ugandan specimen is darker than the Congo specimens.

DISTRIBUTION. Map 63. Democratic Republic of the Congo; Uganda.

MATERIAL EXAMINED.

Holotype ♂, DEMOCRATIC REPUBLIC OF THE CONGO: (*Jackson*), 1926, BM slide no. 10617, in BMNH.

Paratypes. DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Uele, Paulis (*Fontaine*), 12.iii.1956, in MRAC; 1 ♂, Uele, Paulis (*Fontaine*), 23.i.1957, in MRAC; 1 ♀, Sankuru, Katako Kombe (*Fontaine*), 24.xi.1951; 1 ♀, Sankuru, Katako Kombe (*Fontaine*), 4.ii.1953, in MRAC; UGANDA: 1 ♀, Fort Portal, Mpanga Forest (*Carcasson*), v.1958; 1 ♂, Toro, Bwamba (*Archer*), vi.1967.

Opula chopardi (Viette)

Rhodoneura chopardi Viette, 1954 : 120.
Opula chopardi (Viette) Whalley, 1967 : 40, figs 17, 52, 72, 73.

DISTRIBUTION. Madagascar. Map 62.

Opula lineata Whalley

Opula lineata Whalley, 1967 : 41, figs 13, 53, 76.

DISTRIBUTION. Madagascar. Map 63.

GNATHODES gen. n.

Type-species, *Gnathodes helvella* sp. n.

This genus is characterized by the enormous development of the gnathus and the presence of a lateral process on the valve of the male. Various modifications, reductions or loss of the gnathus have taken place in many genera of the Thyrididae but the only other species where a similar enlargement and sclerotization of the gnathus has taken place is in the *Magnifica* species-group of the genus *Dysodia* (Whalley, 1968). The female of *Gnathodes fiscinella* is unknown. The presence of the anal plate over the anal papillae is unusual and it will be interesting to see whether the unknown female of *G. fiscinella* has also developed this. Externally the species of *Gnathodes* are similar to some of the species of *Opula* but the genitalia are quite distinct. It is possible that, when the Oriental fauna is studied, more species of this genus may be found. At present the relationship of *Gnathodes* with other African genera is not clear. This genus is only known from Africa south of Sahara.

GENERIC DESCRIPTION. Labial palps three-segmented. Proboscis present. Fore tibia with epiphysis. Tarsi without spines. Hind tibia with two pairs of spurs. Underside of fore wing with black and silver iridescent scales. Male genitalia with enormously developed and sclerotized gnathus. Valves with strong lateral projection. Female with sclerotized plate over anal papillae.

BIOLOGY. No information.

KEY TO THE AFRICAN SPECIES OF *GNATHODES*

1 Black species. Fore wing with radial veins from cell. Gnathus with a pair of posterior pointing processes (Pl. 46, fig. 260) . . . . ***helvella*** (p. 170)
– Otherwise coloured. Fore wing with R_3+R_4 Gnathus with three, posterior pointing processes . . . . ***fiscinella*** (p. 171)

Gnathodes helvella sp. n.

(Pl. 22, fig. 115; Pl. 46, fig. 260; Pl. 64, figs 407, 408)

♂. Wing, 9·5–10 mm. Vertex white, frons flattened between eyes. Antennae minutely ciliate. Labial palps upturned, just reaching vertex, third segment 1/2 length of second. Thorax yellowish brown. Hind tibia with outer spur of distal pair 2/3 length of inner spur. Fore wing, pattern as in Pl. 22, fig. 115, yellowish brown with reddish brown markings. Median area reddish brown, with reddish brown posterior part to subterminal fascia. Fringe dark. Underside, black and silver iridescent scales in cell in fore wing and along anterior veins. Large antemedial black patch, not reaching costal margin and black posterior subterminal band running forward as far as 1*A*. Black postmedial patch in centre of wing. Radial veins from cell. Hind wing, colour as fore wing, thin reddish median fascia. Fringe dark. Underside paler, no black and silver scales.

GENITALIA ♂ (Pl. 46, fig. 260). Uncus simple, stout and broad at base. Gnathus highly modified and sclerotized with two long lateral posterior projecting processes, usually reaching to or beyond base of juxta. Juxta two sclerotized lateral lobes. Valve broader at apex. Sacculus process sclerotized. Prominent, sclerotized, median basal process with three arms, anterior pair more heavily sclerotized than posterior pair. Aedeagus with minute spines on manica.

♀. Wing, 10·5–11·5 mm. Third segment of labial palp 1/2 length of second. Colour and pattern as in male.

GENITALIA ♀ (Pl. 64, figs 407, 408). Anal papillae short, sclerotized "shield" present dorsal to anal papillae. Ostium simple. Bursa with patches of spines.

DISCUSSION. This species is related to *fiscinella* from which it can be distinguished by its colour and pattern and by the shape of the gnathus in the male. The female of *fiscinella* is unknown. Externally this species is similar to many other African Thyrididae in general appearance but the male genitalia are quite distinct. The remarkable development of the gnathus in this species together with the sacculus process projecting from the edge of the valve is unusual. In the female the development of the sclerotized shield over the base of the anal papilla has not been found in any other species. There is some small variation in the size and pattern of the specimens from Rhodesia and Cameroon.

DISTRIBUTION. Map 12. Cameroon; Mozambique; Malawi; Rhodesia.

MATERIAL EXAMINED.

Holotype ♂, MALAWI: Mt Mlanje, 24.iv.1913 (*Neave*), BM slide no. 9599, in BMNH.

Paratypes. MALAWI: 1 ♀, locality as type, 15.iv.1913; 1 ♀, locality as type, 12.ii.1914; 1 ♂, Mkuwadzi Forest, Nkata Bay, 12.v.1966, in NMR.

Material not included in the type-series. CAMEROON: 1 ♂, Efulen, i.1916 (*Weber*), in CMP; MOZAMBIQUE: 1 ♂, Busi R., Chirinda, x.1953 (*Pinhey*); RHODESIA: 1 ♂, Glenlivet, xi.1955, in NMR.

Gnathodes fiscinella sp. n.

(Pl. 22, fig. 116; Pl. 46, fig. 261)

♂. Wing, 10–10·5 mm. Vertex blackish brown, frons not projecting between eyes. Antennae shortly ciliated. Labial palps strongly upturned reaching vertex, third segment 1/3 length of second. Patagia and prothorax black, rest of thorax lighter coloured. Hind tibia with outer spur of distal pair 1/2 length of inner spur, each spur with sclerotized point. Tarsi smooth. Fore wing, pattern as in Pl. 22, fig. 116, black with darker transverse maculations, underside paler, patch of black and silver scales in cell. Veins R_3 and R_4 with short common stalk. Hind wing, colour and pattern as fore wing, but lacking black and silver scales on underside. $Sc+R_1$ and Rs approach closely but do not fuse.

GENITALIA ♂ (Pl. 46, fig. 261). Uncus elongate and sclerotized. Gnathus highly modified and sclerotized with long median and two lateral projections and one anterior projection. Juxta, narrow plate, with two small lateral lobes. Valves modified. Sacculus process sclerotized, prominent lateral sclerotized process from sclerotized costal margin of base of valve. Aedeagus with minute spines in vesica.

♀. Unknown.

DISCUSSION. Externally this species is similar to *Neobanisia fuliginea* but the

genitalia are quite distinct. The large gnathus is a similar development to that in *helvella* but the shapes are different in these two species.

DISTRIBUTION. Map 12. Democratic Republic of the Congo; Angola.

MATERIAL EXAMINED.

Holotype ♂, DEMOCRATIC REPUBLIC OF THE CONGO: Elisabethville, 26.iii.1936 (*Seydel*), BM slide no. 10552, in MRAC.

Paratype, ANGOLA: 1 ♂, Mt Moco, Luimbale, 1800–1900 m, 16.iii.1934 (*Jordan*).

SINECALCA gen. n.

Type-species, *Sinecalca insolita* sp. n.

Although two new species are described in this genus, one of them (*S. confusa*) differs in a number of characters from the type-species and further material of this species is needed to evaluate its generic position. Basically the genus *Sinecalca* contains two species where the frenulum is absent in both sexes. Both species have some morphological similarities, with long, slender bodies, similar wing shapes and similar genitalia. However, apart from differences in the origin of the radial veins of the wing, the epiphysis on the fore tibia is absent in both sexes of *S. insolita*.

The loss of the frenulum has not been found in any other Thyridid genus in Africa and the loss of the epiphysis is peculiar to *S. insolita*. The frenulum is lost in some species in other families of the Lepidoptera, e. g. Drepanidae (Watson, 1965 : 5), apart from the families in which the frenulum is absent in all species (e. g. Hepialidae). The loss of the epiphysis occurs occasionally in other families of Lepidoptera, e.g. Drepanidae, Nidarinae (Watson, 1965). Both species of *Sinecalca* differ in the number of pairs of spurs on the hind tibia, *S. confusa* has two pairs but *S. insolita* has only one pair on the hind tibia, this condition is found in several Thyridid genera and is characteristic of the genus *Cecidothyris*.

The relationship of the genus *Sinecalca* with the other genera in the Thyrididae is not clear. It shows some special characters but it also has characters in common with other genera. The genitalia are similar to some of the species of *Cecidothyris* and the genus *Sinecalca* is thus placed tentatively near that genus. However, since both these genera have certain peculiar specializations (? simplifications), speculation on their affinities is of little value at present.

The genus is known at present only from the mainland of Africa.

GENERIC DESCRIPTION. Proboscis reduced. Eyes without interfacetal hairs. Labial palps 3-segmented. Antennae ciliate or monopectinate. Frenulum absent. Fore tibia with or without epiphysis. Hind tibia with one or two pairs of spurs. Tarsi without spines. Radial veins of fore wing from cell or with R_3+R_4. Gnathus in male, weakly sclerotized loop. Female without signum in bursa.

BIOLOGY. No information.

KEY TO THE AFRICAN SPECIES OF *SINECALCA*

1 Epiphysis on fore tibia. R_3 and R_4 in fore wing from cell . . . **confusa** (p. 173)
– No epiphysis on fore tibia. R_3+R_4 in fore wing with common stem . **insolita** (p. 173)

Sinecalca insolita sp. n.

(Pl. 22, fig. 117; Pl. 46, fig. 262; Pl. 67, fig. 434)

♂. Wing, 10–12·5 mm. Vertex brown. Antennae ciliate. Frons not projecting between eyes. Proboscis reduced. Labial palps with third segment 1/2 length of second segment. Eyes large, almost touching ventrally below head. Thorax brown. No epiphysis on fore tibia. Hind tibia with one pair of spurs, outer spur slightly shorter than inner spur. First hind tarsal segment long, equal to length of hind tibia. Abdomen long, rather slender, narrowing in first abdominal segment. Fore wing, pattern as in Pl. 22, fig. 117, grey-brown with darker transverse markings. Terminal margin slightly sinuate, apex pointed. Veins R_3 and R_4 stalked. Underside similar to upperside, paler. Hind wings, colour and pattern as fore wing but with median fascia darker. Underside similar. $Sc+R_1$ and Rs free. Frenulum absent. Area in front of $Sc+R_1$ slightly enlarged.

GENITALIA ♂ (Pl. 46, fig. 262). Uncus simple. Median basal process sclerotized, slightly sinuate. Juxta, two small lateral lobes. Valve simple, broader at apex than middle. Aedeagus with spiny vesica.

♀. Wing, 15–17·5 mm. Colour and pattern as male. Labial palps and venation similar. Frenulum absent No epiphysis on fore tibia.

GENITALIA ♀ (Pl. 67, fig. 434). Anal papillae short. Ostium broad, covered with minute spines. Duct of bursa and bursa covered with minute spines.

DISCUSSION. Although this species has typical Thyridid venation and genitalia the lack of the epiphysis on the fore tibia makes it unique amongst the African Thyrididae. The loss of the frenulum, which it share with *S. confusa*, is also peculiar in the African fauna. The presence of only one pair of tibial spurs is another unusual character but this does occur in a number of Thyridid genera (e. g. *Cecidothyris* and some species of *Chrysotypus*).

The relationship of *S. insolita* to *S. confusa* is not clear, they share certain common features, notably the loss of the frenulum, but *insolita* has a number of peculiar characters not shared by *confusa*. It is possible that *S. confusa* may need a separate genus but this may be apparent when other faunae are studied. Until the world fauna of the Thyrididae is examined more thoroughly, the importance of the loss of the frenulum and epiphysis in the classification of the species cannot be estimated.

DISTRIBUTION. Map 11. Tanzania.

MATERIAL EXAMINED.

Holotype ♂, TANZANIA: Ugano, Matengo-Hochland, 1500–1700 m, WSW., Songea (*Zerny*), 1–10.ii.[19]36, BM slide no. 10107, in NHV.

Paratypes. TANZANIA: 1 ♂, 2 ♀, locality as type, 11–20.ii.1936, one ♂, one ♀ in NHV; 1 ♂, locality as type, 21–29.ii.1936; 1 ♂, 3 ♀, locality as type, 11–20.iii.1936, one ♂, two ♀ in NHV; 1 ♀, locality as type, 1–10.iii.1936, in NHV; 1 ♀, Ugano, 1500–1700 m, Matengo-Hochland, WSW. Songea, 26.iii.1938 (*Zimmer*), in NHV.

Sinecalca confusa sp. n.

(Pl. 22, fig. 118; Pl. 46, fig. 263; Pl. 67, fig. 435)

♂. Wing, 15–16 mm. Vertex brown. Antennae monopectinate with short pectinations covered with long cilia. Frons brown, not projecting between eyes. Labial palps with third segment slightly less than 1/2 length of second, upturned, reaching just to vertex. Proboscis

present, small. Thorax brown. Fore tibia with epiphysis. Hind tibia with two pairs of spurs, outer spur of distal pair almost equal to inner spur, much shorter than 1st hind tarsal segment. First hind tarsal segment shorter than tibia, tarsal segments 1–4 without spines, last tarsal segment on each leg with a group of spines. Fore wing, pattern as in Pl. 22, fig. 118, grey-brown with darker transverse markings and a prominent black mark over apex of cell. Radial veins from cell. Underside, as upperside but paler. Hind wings, colour as fore wings, underside paler than upper. $Sc+R_1$ and Rs free. Frenulum absent, area in front of $Sc+R_1$ enlarged.

GENITALIA ♂ (Pl. 46, fig. 263). Uncus simple. Valves simple, apex slightly broader than half way along. Basal process sclerotized, sinuous. Juxta two small lateral lobes. Vesica of aedeagus without spines.

♀. Wing, 17–21·5 mm. Antennae ciliate without the pectinations of the male. Colour and pattern as male. Frenluum absent.

GENITALIA ♀ (Pl. 67, fig. 435). Anal papillae short. Ostium broad, covered with minute spines. Duct and bursa covered in minute spines.

DISCUSSION. Some of the similarities between *insolita* and *confusa* are remarkable, the male genitalia are very similar although the aedeagus of *insolita* has spines in the vesica. The wing pattern is similar but *confusa* has a prominent black mark over the cell and the radial veins differ slightly in their origins. The most striking difference between the two species is the absence of the epiphysis on the fore tibia of *insolita* and only a single pair of spurs on the hind tibia (see also under *insolita*).

DISTRIBUTION. Map 11. Democratic Republic of the Congo; Malawi; Kenya; Tanzania.

MATERIAL EXAMINED.

Holotype ♂, KENYA: Namanga, iv.1951 (*Jackson*), BM slide no. 10106, in BMNH.

Paratypes. DEMOCRATIC REPUBLIC OF THE CONGO: 1 ♂, Elisabethville, 2.i.1935 (*Seydel*), in MRAC; 1 ♀, Kapiri, ix.1912, in MRAC; MALAWI: 1 ♂, Nkata Bay, vi.1961; 1 ♀, Nkata Bay, Bulungo, 2600 ft, 3.vi.1962 (*Gifford*), in NMK; 1 ♀, Mlanje Distr., iii–iv.1925 (*Barlow*); 3 ♂, Nkata Bay, Mkuwadzi Forest, 12.v.1966, two ♂ in NMR; KENYA: 1 ♀, Makindu (*Feather*), in USNM; 1 ♀, Nairobi, Thika R., iv.1951 (*Pinhey*); TANZANIA: 1 ♀, Amani, v.1963 (*Pringle*).

LELYMENA Karsch

Lelymena Karsch, 1900 : 251. Type-species, *Lelymena misalis* Karsch, by monotypy.
[*Rhodoneura* sensu Gaede, 1917 : 360, nec Guenée.]
[*Rhodoneura* (partim) sensu Whalley, 1964a : 125, nec Guenée.]

This genus is retained for the single species *L. misalis* Karsch. This species is unlike any other Thyridid in colour and pattern, the pale lemon-yellow wings and absence of the typical thyridid reticulate pattern make this species unique in the family. The wing venation is variable, even varying between the left and right sides of the same specimen. There is also a tendency for some of the specimens to develop transverse veins, this has not been found in any other species of Thyridid, however the peculiar colouration of *L. misalis* with the black scales lining the wing veins makes any anomalous situation obvious.

There are no clear affinities of this genus. It can be separated from *Rhodoneura* by the lack of the spines on the tarsal segments. Certain features of the genitalia of

the male (broad valve, lack of complete gnathus) and of the female (slightly folded anal papillae) suggest that this genus may have some affinities with *Chrysotypus* but otherwise no close affinities can be suggested at present. This monotypic genus is restricted to the mainland of Africa, from 20° south to 10° north latitude. It does not extend into South Africa and at present only a single specimen (type of *misalis*) is recorded from West Africa.

Generic description. Proboscis present. Labial palps 3-segmented. Fore wing with R_4+R_5. Fore tibia with epiphysis. Hind tibia with two pairs of spurs. Tarsi without spines. Male with broad valve. Gnathus incomplete, lateral arms (brachia) not meeting in mid-line. Female without signum in bursa.

Biology. No information.

Lelymena misalis Karsch comb. rev.

(Pl. 2, L; Pl. 45, fig. 259; Pl. 67, figs 432, 433)

Lelymena misalis Karsch, 1900 : 251.
Rhodoneura palealides Hampson, 1906 : 120. (Synonymised by Gaede, 1917: 359).
Rhodoneura palealides Hampson; Dalle Torre, 1914 : 30.
Rhodoneura misalis (Karsch) Gaede, 1917 : 360.
Rhodoneura palealides Hampson; Gaede, 1917 : 360.
Rhodoneura misalis (Karsch); Gaede, 1929 : 492.
Rhodoneura misalis (Karsch); Whalley, 1964a : 125.

♂. Wing, 19–23·5 mm. Vertex and frons bright yellow. Antennae black, slightly serrate, covered with minute hairs. Labial palps 1–1½ × diameter of eye, upturned, almost reaching vertex. Third segment more than 1/2 length of second segment, almost completely black, 1st and 2nd segments yellow. Thorax lemon-yellow. Fore and mid tibia and tarsi black. Hind tibia with spurs short, less than 1/2 length of 1st tarsal segment. Spurs pale yellow with black outer spur of hind tibia slightly more than 1/2 length of inner spur. Fore wing, pattern as in Pl. 2, L, pale yellow with black veins and margins. R_4 and R_5 stalked or free. 1*A* and 2*A* fuse a short distance from origin to form single vein to wing margin. Underside, very pale lemon-yellow, wing veins not as clearly demarcated as on upper side. Hind wing, $Sc+R_1$ and *Rs* free. Veins less clearly lined with black than fore wing.

Genitalia ♂ (Pl. 45, fig. 259). Uncus simple. Gnathus lightly sclerotized on mid-line, two lateral sclerotized processes, one on each side of middle. Transtilla broad, covered with spines. Juxta, simple two lateral lobes. Valve simple, basal process ending in small peg-like tooth. Aedeagus without cornuti.

♀. Wing, 25–27 mm. Labial palps 2 × diameter of eye. Colour and pattern as in male.

Genitalia ♀ (Pl. 67, figs 432, 433). Anal papillae short. Area round ostium strongly convoluted. Bursa without signum.

Discussion. This species is unlike any other species of Thyridid in colour and pattern. The wing venation of this species is variable. The fusion of R_4 and R_5 does not occur in all specimens, small, extra veins appear, even partial cross-veins and short extra branches of 1*A* and 2*A* are common. In one specimen R_1 and R_2 have a short, common stalk on one side only; 2*A* is absent in some specimens. No clear indication of the relationship of this striking species can be given. Some aspects of its morphology suggest it might be near species of the genus *Chrysotypus*.

Distribution. Map 10. Togo; Democratic Republic of the Congo; Uganda; Tanzania; Kenya; Ethiopia; Zambia; Rhodesia; Angola; South Africa.

MATERIAL EXAMINED.

Holotype ♂ (*misalis*), TOGO: in ZMB; Holotype ♂ (*palealides*), RHODESIA: Mashonaland, Salisbury, xi.1900 (*Marshall*), BM slide no. 9567, in BMNH.

DEMOCRATIC REPUBLIC OF THE CONGO: 4 ♂, 1 ♀, Elisabethville, xii.1948, xiii. 1950, xi.1954 (*Seydel*); UGANDA: 1 ♂, Nsongezi, Kagera River, x.1962 (*Carcasson*), in NMK; 2 ♂, Jinja, Mulange, iv.1922 (*Dummer*); TANZANIA: 1 ♂, Sorea, 3800 ft, i.1933 (*Johnston*); 1 ♀, Nachingwea, iv.1961 (*Bigger*); KENYA: 1 ♂, Mt Elgon, v.1934 (*Jackson*); 8 ♂, 1 ♀, Suna, S. Kavirondo, iii.1931–iii.1932 (*Feather*); 1 ♂, Jacaranda Res. Station, Ruiru, iv.1960; 1 ♂, Kilimanjaro, versant sud-est, Neu-Moshi, 800 m, zone inferieure, iv.1912 (*Alluaud & Jeanne*), in MNHN; ETHIOPIA: 1 ♂, Alaba-Kambata, iv.1925 (*Neumann*); ZAMBIA: 1 ♂, Abercorn, xi.1963 (*Vesey-Fitzgerald*), in NMK; RHODESIA: 1 ♂, 1 ♀, Khami, nr Bulawayo, xii.1955–xi.1956, in NMR; 1 ♂, Sebakwe, ii.1902 (*Dods*); 2 ♂, Emangeni, i.1918 (*Janse*); 1 ♂, 1 ♀, Bulawayo, 1–2.xii.1919 (*Janse*), in TMP; 1 ♂, Umtali Distr., 31.xii.1928 (*Shepherd*), in TMP; ANGOLA: 1 ♂, 1 ♀, Upper Cubango-Cunene watershed, 5500 ft, x.1928 (*Barns*); SOUTH AFRICA: 1 ♂, Limburg, Potgietersrus Distr., Tvl., 12.xii.1963 (*Vari*), in TMP; 1 ♂, Griffin Mine, i.1915 (*Breijer*), in TMP.

CECIDOTHYRIS Aurivillius

Cecidothyris Aurivillius, 1910 : 159. Type-species, *Cecidothyris guttulata* Aurivillius, by monotypy.
[*Oxycophina* sensu Gaede, 1917 : 359, nec Warren.]
[*Oxycophina* sensu Gaede, 1929 : 494, nec Warren.]
Cecidothyris Aurivillius; Whalley, 1964a : 115.

Although this genus has previously been synonymized with *Oxycophina* Warren, the two genera are quite distinct. *Cecidothyris* is characterized by the fusion of the third and second segments of the labial palps and by the presence of only one pair of tibial spurs. *Oxycophina* is more typical of most thyridid genera in having a three-segmented labial palp and two pairs of tibial spurs.

This genus is clearly separated from all the other African genera of Thyrididae by the fusion of two segments of the labial palps. The genitalia of the males of all the species are rather similar, with only *C. tyrannica* having a prominent process on the middle of the gnathus. The veins in the fore wing of specimens of *C. pexa* differ in the origin of R_3 and R_4 which may be shortly stalked or arise from the cell and other variations in the origin of the radial veins have been found. Apart from the characters mentioned before, *C. parobifera* has a bifid tarsal claw, a character which is unique amongst the African Thyrididae although common in many families of Rhopalocera.

Cecidothyris does not seem to have any close relationship with the other African genera and its relationship with the Indo-Australian genera is not known. The genus, which contains six species, is peculiar to Africa where it extends over the whole continent south of Sahara, but does not occur in Madagascar. Most of the species occur in west and central Africa with only one subspecies of *C. pexa* extending into southern Africa.

GENERIC DESCRIPTION. Proboscis present. Antennae bipectinate or ciliate, not simple. Eyes without interfacetal hairs. Labial palps 2-segmented. Fore tibia with epiphysis. Hind tibia with one pair of spurs. Tarsi without spines. Uncus simple, valve simple, without process. Bursa without signum.

BIOLOGY. *C. pexa* has been bred from galls on twigs of species of *Terminalia*. *C. pexa pexa* has been bred from *Terminalia sericea* and *C. pexa guttulata* produces galls on *Terminalia avicennoides* (Ufaruna, 1968). The host plants of the other species is not known.

KEY TO THE AFRICAN SPECIES OF *CECIDOTHYRIS*

1		Antennae shortly ciliate	***longicorpa*** (p. 184)
–		Antennae pectinate	2
2	(1)	Large oval or round, white maculations with two prominent round or oval ones in median area	3
–		Not so patterned, maculations, when present, small	4
3	(2)	Reddish brown species, maculations tending to be oval. Tarsal claws bifid (Pl. 68, fig. 446)	***parobifera*** (p. 181)
–		Brown species, maculations tending to be round. Tarsal claws simple	***orbiferalis*** (p. 181)
4	(2)	Small maculations all over wing (Pl. 2, R, S), particularly in terminal and sub-terminal areas. Male with median process to gnathus	***tyrannica*** (p. 182)
–		Maculations, if present, restricted to median and basal areas. No median process on gnathus	5
5	(4)	Hind wing with narrow median fascia (Pl. 23, fig. 122)	***chrysotherma*** (p. 180)
–		Hind wing with broad median fascia, usually with small maculations in it (Pl. 2, N, O)	***pexa*** (p. 177)

Cecidothyris pexa (Hampson)

Rhodoneura pexa Hampson, 1906 : 117.

This species is widespread over Africa south of Sahara. It produces galls on species of *Terminalia*. These galls are very similar to those produced on *Muhlenbeckia australis* by the New Zealand Thyridid, *Morova subfasciata* Walker (Arnold, 1966). In west, east and central Africa specimens of this species are dark brown with heavy markings on the fore and hind wings. From Rhodesia to South Africa the specimens are much paler in colour on the wings. There is some overlap in the intensity of colouration of specimens from Rhodesia, some being darker than the typical southern specimens. Examination of the scales on the fore wing shows that the pale southern specimens tend to have longer and more slender scales than the darker specimens, otherwise they are morphologically similar. There is a tendency for light coloured males from the south to be smaller than the males from the rest of Africa. A fair amount of individual variation exists within the light and dark series. I regard the two series as subspecies of one widely distributed species. In the genus *Cecidothyris*, although there is some variation in wing pattern within the species, there is little intra-specific variation in the genitalia. Considerable variation in wing size exists in both sexes but the females are generally larger than the males.

KEY TO THE SUBSPECIES OF *CECIDOTHYRIS PEXA* Hampson

1 Dark brown pattern on median and basal area of fore and hind wings ***p. guttulata*** (p. 179)
– Pale brown pattern on median and basal areas of fore and hind wings . ***p. pexa*** (p. 178)

Cecidothyris pexa pexa (Hampson) comb. n.

(Pl. 2, N; Pl. 23, figs 125, 126; Pl. 46, fig. 264; Pl. 68, figs 438, 439)

Rhodoneura pexa Hampson, 1906 : 117.
Rhodoneura pexa Hampson; Dalle Torre, 1914 : 30.
Oxycophina pexa (Hampson) Gaede, 1917 : 369.
Oxycophina pexa (Hampson); Gaede, 1929 : 494.

♂. Wing, 10·5–18 mm. Vertex brown, irrorate with white, frons rounded, usually narrower than long, occasionally enlarged. Antennae strongly bipectinate. Labial palps with second segment slightly longer than first, short, not reaching vertex. Thorax brown, irrorate with white. Outer spur of hind tibia slightly shorter than inner. First hind tarsal segment more than 2 × length of tibial spur. Fore wing, pattern as in Pl. 2, N, pale brown with darker brown markings. Fore wing pattern slightly obscured by a light dusting of scales. Underside, pattern of median and basal areas very dark brown with prominent reticulations. Terminal and subterminal areas as on upperside. Radial veins usually from cell. Veins 1*A* and 2*A* forming loop at base, joining to form single vein to wing margin. Frenulum with one bristle. Hind wing, median and basal areas darker than terminal with prominent reticulate pattern. Underside with median fascia darker. $Sc+R_1$ and *Rs* free.

GENITALIA ♂ (Pl. 46, fig. 264). Uncus simple, gnathus present, valve simple. Juxta with spiny lateral lobes. Aedeagus with vesica covered with minute spines.

♀. Wing, 12·5–19 mm. Colour and pattern as male, sometimes a darker brown. Frenulum with 3 or 4 bristles.

GENITALIA ♀ (Pl. 68, figs 438, 439). Anal papillae short. First part of duct lightly sclerotized. No signum.

DISCUSSION. This subspecies is separated from *C. pexa guttulata* Aurivillius by its paler colour and more obscured pattern on the fore wing. Even a series of very small specimens from Blauwkop (S. Africa), in which the pattern is very faint, is otherwise morphologically similar to the rest of the specimens of *pexa pexa*. In Rhodesia, where both subspecies occur, there is a tendency for intermediates to occur which are difficult to assign to either subspecies. The shape of the frons varies, in most specimens of *p. pexa* the frons is fairly narrow and not swollen whereas in *p. guttulata* the frons is usually swollen and much enlarged. This seems to be fairly constant in *p. guttulata* although small specimens of this subspecies from Tanzania have a narrower than average width frons. There seems to be a trend to produce a less bulbous frons in the subspecies *p. pexa* than in *p. guttulata*. The enlarged frons is also found in *C. tyrannica* Whalley but not in *C. chrysotherma* Hampson. *C. p. pexa* has been bred from *Terminalia sericea*, where it forms galls on the twigs (Pl. 23, fig. 126), see p. 19.

DISTRIBUTION. Map 73. Rhodesia; South West Africa; Botswana; Lesotho; South Africa.

MATERIAL EXAMINED.

Holotype ♂, SOUTH AFRICA: C[ape] Colony, 99–336, BM slide no. 9041, in BMNH.
RHODESIA: 1 ♂, Bulawayo, iii.1925 (*Higgins*), in CMP; 2 ♀, Khami, nr Bulawayo,

iii.1956, one ♀ in NMR; 1 ♂, Sinoia, 21.iii.1950 (*Mitton*), in NMK; 1 ♀, Umvuma, ii.1919 (*Janse*), in TMP; 1 ♀, Umtali, Mashonaland (*Marshall*), (paratype); 1 ♂, Sebakwe, i.1902 (*Dods*), in CT; 1 ♂, Shamva, xii.1920 (*O'Neil*); SOUTH WEST AFRICA: 1 ♂, Abachaus, [160 ml N. Windhoek], iv.1944 (*Hobohm*), in TMP; 4 ♂, 2 ♀, Omuramba, Tamsu, Okavango, 14.ii.1956 (*Winter & Mavais*), three ♂, two ♀ in TMP; 1 ♂, Runtu, Okavango, 8.ii.1956 (*Winter*), in TMP; BOTSWANA: 1 ♂, Topsi, 11.ii.1921 (*Godman*); 2 ♂, Makala-ma-Bedi, Botletle River, 6.ii.1967, one ♂ in TMP; LESOTHO: 1 ♂, Maseru (*Dicterlen*), in CT; SOUTH AFRICA: 1 ♂, 1 ♀, Skukuza, KNP survey, 10–13.ii.1963 (*Vari*), one ♂ in TMP; 1 ♂, Transvaal, Lydenburg (*Distant*); 1 ♂, Slypsteendrift, 28.xii.1924 (*Janse*), in TMP; 1 ♂, Tenby Downs, ii.1928 (*Clarke*), in TMP; 1 ♂, Rooiberg, 15.iv.1960 (*Copley*), in TMP; 1 ♀, Maraheki, TP., 14.ii.1953 (*Munro*), in TMP; 2 ♀, Pretoriuskop, 31.iii–1.iv.1952 (*Vari*), one ♀ in TMP; 1 ♂, Nylstroom, 4–5.iii.1954 (*Janse*), in TMP; 4 ♂, Blauwkop, 30.i.1925 (*Janse*), three ♂ in TMP; 1 ♂, Cape Colony; 1 ♀, Potgietersrus, Transvaal, ii.1950 (*Mitton*); 1 ♂, Pretoria N., 20.i.1954 (*Rorke*), in TMP; 1 ♂, Pretoria North, 20.ii.1917 (*Swierstra*), in TMP.

Cecidothyris pexa guttulata Aurivillius **stat. n.**

(Pl. 2, O; Pl. 46, fig. 265)

Cecidothyris guttulata Aurivillius, 1910 : 160.
Oxycophina guttulata (Aurivillius) Gaede, 1917 : 369.
Oxycophina guttilata (Aurivillius); Gaede, 1929 : 495.
Cecidothyris guttulata Aurivillius; Whalley, 1964a : 118.

♂ and ♀. Wing, 11–21 mm (♂), 19–22·5 mm (♀). Externally the dark brown pattern on the median and basal areas of the fore and hind wing separates this subspecies from the nominate one (Pl. 2, O). The frons is usually much enlarged, projecting between the eyes. Veins R_3 and R_4 fuse for part of their length in many specimens from West Africa and all intermediates from R_3 and R_4 completely free occur. Considerable variation occurs in the intensity of the colour and of the pattern, but from the specimens examined they appear to be equally variable over the whole range. There is a tendency for the specimens from West Africa to have a much darker terminal and subterminal area on the wing than the specimens from East Africa.

GENITALIA ♂ (Pl. 46, fig. 265).

The larvae of this subspecies, as with the nominate subspecies, produce galls on the twigs of *Terminalia* species but in this case a different species of *Terminalia*, *T. avicennoides* (Ufaruna, 1968), see p. 19.

DISTRIBUTION. Map 73. Senegal; Guinea; Ivory Coast; Ghana; Nigeria; Sudan; Central African Republic; Democratic Republic of the Congo; Kenya; Tanzania; Mozambique; Malawi; Zambia; Rhodesia; Angola.

MATERIAL EXAMINED.

Holotype ♂, TANZANIA: Zumbo, BM slide no. 9040, in NR.

SENEGAL: 7 ♂, 1 ♀, Sedhiou (*Castell*), viii–x.1917; GUINEA: 2 ♂, 2 ♀, Beyla (*Mrázek*), in MMB; IVORY COAST: 1 ♀, Dimbrokou, 1915; 1 ♂, S. of Touba, Bafing River, 1200 ft, 4.vii.1926 (*Collenette*); GHANA: 6 ♂, 1 ♀, N. Territories, Kete-Krachi (*Cardinall*); NIGERIA: 3 ♂, Abinsi, River Benue, v.1912; 1 ♀, Samara, vi.1968 (*Roberts*), ex gall on *Terminalia avicennoides*; 1 ♂, Bauchi Plateau; 1 ♀, Jos, 8.viii.1924

(*Pomeroy*); 1 ♂, Jos, v.1960 (*Boorman*); 1 ♂, 1 ♀, Ropp, 13.vii.1920; SUDAN: 1 ♂, Tambura, xii.1922; CENTRAL AFRICAN REPUBLIC: 2 ♂, Fort Crampel (*Le Moult*); DEMOCRATIC REPUBLIC OF THE CONGO: 2 ♂, 2 ♀, Elisabethville, 1951–54 (*Seydel*), in CMP; 1 ♂, Kabongo, 28.x.1953 (*Seydel*), in CMP; 1 ♂, Mutamba, Shibong, Katanga Distr., xi.1934; 1 ♂, Lualabo, Kolwezi, xii.1956 (*Allard*); 1 ♂, Kafakumba, 12.iii.1925; 1 ♂, Dilolo, ii.1931 (Dzion), in MRAC; KENYA: 2 ♂, Machakos, Makueni, iii.1957 (*Pearsons*), in NMK; 2 ♂, 2 ♀, Kitale, iv.1953 (*Howard*), one ♀ in NMK; 1 ♂, Kitali, vi.1934 (*Jeffery*); 1 ♂, Suna, S. Kavirondo, v.1932 (*Feather*); 1 ♂, Yatta Kitui, iv.1960 (*Carcasson*); 1 ♂, Kibwezi, iv.1917 (*Feather*); 1 ♂, Malaba Forest, vi.1957 (*Howard*), in NMK; TANZANIA: 1 ♂, Chunya, Chunya Distr., i.1947, 2650 ft (*Swynnerton*); 3 ♀, Nachingwea, iv.1961 (*Bigger*), one ♀ in NMK; 1 ♂, Kigoma, 19.v.1928 (*Grant*); MOZAMBIQUE: 1 ♂, Kola Valley, 6.iv.1913 (*Neave*); MALAWI: 1 ♂, ii.1925 (*Barlow*); ZAMBIA: 1 ♂, Mumbwa, 19.xi.1957 (*Dening*); 1 ♂, Broken Hill, 24.ii.1950 (*Mitton*), in TMP; 2 ♂, Mwengwa, ii–iii.1914 (*Dollman*); 1 ♂, Lusaka, i.1960, in NMR; RHODESIA: 1 ♂, Salisbury, ii.1956, in NMR; 1 ♂, Mazoe, 6–17.i.1920 (*Janse*), in TMP; 1 ♂, Salisbury, 17–19.ii.1950 (*Mitton*), in TMP; ANGOLA: 1 ♂, Bihé; 1 ♀, Ceramba, Bihé, iii.1903 (*Bell*).

Cecidothyris chrysotherma (Hampson) **comb. n.**

(Pl. 23, fig. 122; Pl. 47, fig. 266; Pl. 68, figs 440, 441)

Betousa chrysotherma Hampson, 1914 : 111.
Betousa chrysotherma Hampson; Gaede, 1917 : 370.
Betousa chrysotherma Hampson; Gaede, 1929 : 496.

♂. Wing, 13–14 mm. Vertex yellowish brown, frons rounded, only slightly protruding in front of eyes when viewed laterally. Clypeus with small sclerotized point (not visible through scales.) Antennae strongly bipectinate. Labial palps short, not reaching vertex. Thorax, tegulae, brown irrorate with white scales. Hind tibia with outer spur more than 1/2 length of inner spur. Fore wing, pattern as in Pl. 23, fig. 122, dark brown with paler subterminal areas. Slight pinkish tinge to median and ante-median areas. Costal margin irrorate with white scales giving a grey appearance. R_3 and R_4 with common stalk. Vein $1A$ and $2A$ free at base, joining to form single vein to wing margin. Underside, paler than upper, median brown area reduced in size. Hind wings, colour as fore wing, median area, narrow, brown. $Sc+R_1$ and Rs free, cell almost closed.

GENITALIA ♂ (Pl. 47, fig. 266). Uncus simple, gnathus present with slight projection in centre. Aedeagus with minutely spined vesica.

♀. Wing, 15–18 mm. Antennae serrate, colour and pattern as in male but median brown fascia on fore wing with lighter centre than male.

GENITALIA ♀ (Pl. 68, figs 440, 441). Anal papillae short, neck of duct with short, chitinized, part near ostium. Bursa without signum.

DISCUSSION. The dark brown colour of this species is constant but the pattern is slightly variable. From *C. p. guttulata* it can be distinguished in the male by the more lightly patterned underside and the genitalia. The female of *C. p. guttulata* has a broader median fascia in the hind wing than *C. chrysotherma*, otherwise these two species are similar. Generally *C. p. guttulata* is larger and darker than *C. chrysotherma*.

DISTRIBUTION. Map 8. Ghana; Sierra Leone.

MATERIAL EXAMINED.

Holotype ♀, GHANA: Ashanti, Obuassi, 150 ml inland, end of wet and dry season, 1902–03 (*Bergman*), BM slide no. 9619, in BMNH.

SIERRA LEONE: 1 ♂, Bo, i.1958 (*Taylor*); 3 ♂, Bo, xii.1967 (*Revell*); GHANA: 1 ♂, 1 ♀, Kumasi, x.1926 (*Crewdson*); 2 ♂, Insuta, Ashanti, ix.1928 (*Pomeroy*); 1 ♂, Juaso, xi.1936 (*Cansdale*); 1 ♂, Ashanti, Juaso, viii.1937 (*Cansdale*).

Cecidothyris orbiferalis (Gaede) **comb. n.**

(Pl. 2, P; Pl. 47, fig. 267; Pl. 68, fig. 442)

Proterozeuzis orbiferalis Gaede, 1917 : 380.
Proterozeuzis orbiferalis Gaede; Gaede, 1929 : 497.

♂. Wing, 12–14·5 mm. Vertex white, irrorate with brown scales. Frons white, bulbous. Antennae strongly bipectinate. Labial palps with second segment slightly longer than first. Thorax and patagia white, irrorate with reddish brown scales. Fore wing, pattern as in Pl. 2, P, brown with large circular maculations. Costal margin grey, basal area of wing with white spots. Underside whiter in terminal and subterminal areas, basal area lighter than upper surface. Radial veins usually from cell, $1A$ and $2A$ with common base, $2A$ coming off 1/3 from base, almost reaching wing margin. Hind wing, colour and pattern as fore wing. Underside, white, pattern only slightly visible. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 47, fig. 267). Uncus simple. Gnathus without prominent median projection. Vesica in aedeagus minutely spined.

♀. Wing, 16–18 mm. Colour and pattern as in male.

GENITALIA ♀ (Pl. 68, fig. 442). Anal papillae short. Neck of duct slightly constricted and sclerotized. Bursa without signum.

DISCUSSION. This species is similar externally to *C. parobifera* Whalley but can be distinguished by the brown (not reddish brown) colour and general smaller maculations. The tarsi of specimens of *orbiferalis* have single claws while those of *parobifera* are bifid. The genitalia of the two species are similar. It is possible that *parobifera* may only be a subspecies of *orbiferalis* but since both occur together in central Africa, I regard them as distinct species. Wing venation varies in this species, in most specimens R_4 and R_5 were free but in a few specimens these veins joined together near the cell.

DISTRIBUTION. Map 8. Ghana; Togo; Central African Republic; Uganda; Rhodesia.

MATERIAL EXAMINED.

Holotype ♂, TOGO: BM slide no. 9705, in ZMB.

GHANA: 1 ♂, 2 ♀, N. Territories, Kete-Krachi (*Cardinall*); CENTRAL AFRICAN REPUBLIC: 1 ♂, 1 ♀, Fort Crampel (*Le Moult*); UGANDA: 2 ♂, Dokolo, 14.xi.1933 (*Johnston*); 2 ♂, Budongo, xii.1964 (*Brown*); RHODESIA: 1 ♂, Umtali, ix–x.1953 (*Shephard*), in NMK.

Cecidothyris parobifera **sp. n.**

(Pl. 2, Q; Pl. 47, fig. 268; Pl. 68, figs 443, 444, 445, 446)

♂. Wing, 14·5–15·5 mm. Vertex reddish brown with white centre. Frons rounded. Antennae strongly bipectinate. Thorax, patagia white, rest of thorax reddish brown irrorate with white. Legs reddish brown with white bands round apex of tarsi and tibia. Terminal claws of legs bifurcate (Pl. 68, fig. 446). Fore wing, pattern as in Pl. 2, Q, reddish brown with

circular white marks. Veins R_4 and R_5 with common stalk. $2A$ off short stem of $1A+2A$. Underside similar to upperside, paler. Hind wing with $Sc+R_1$ free from Rs.

GENITALIA ♂ (Pl. 47, fig. 268). Uncus simple. Gnathus with very small projection near centre. Basal process on valve lightly sclerotized. Aedeagus with few spines on vesica.

♀. Wing, 17 mm. (Head missing from only female specimen.) Colour and pattern as in male. Fore wing, R_4 and R_5 very shortly stalked. $1A$ and $2A$ free at base, join for short distance near margin.

GENITALIA ♀ (Pl. 68, figs 443, 444). Anal papillae short, neck of bursa lightly sclerotized near ostium. No signum in bursa.

DISCUSSION. This species is easily recognized by its pattern of circular white marks, with much larger pattern than in *C. tyrannica* Whalley. The bifid tarsal claws found in *C. parobifera* separate this species from *C. orbiferalis*. Both *orbiferalis* and *parobifera* lack a prominent projection at the centre of the gnathus which is found in *C. tyrannica* (see also under *orbiferalis*).

DISTRIBUTION. Map 8. Nigeria; Central African Republic; Kenya.

MATERIAL EXAMINED.

Holotype ♂, KENYA; Kitale, v–vi.1962 (*Dougall*), BM slide no. 9966, in BMNH.

Paratypes. NIGERIA: 1 ♂, Zaria, Samaru, 10.viii.1968 (*Deeming*), MV light trap; KENYA: 1 ♂, Kitale, iv.1953 (*Howard*); 1 ♂, Kitale, v.1935 (*Jeffery*); CENTRAL AFRICAN REPUBLIC: 1 ♂, 1 ♀, Fort Crampel (*Le Moult*).

Cecidothyris tyrannica sp. n.

This species can be separated from *C. parobifera*, which it most closely resembles, by the colour and size of the maculations of the fore and hind wing. These maculations are large and white in *parobifera* but small and yellowish brown in *tyrannica*. The underside of *tyrannica* has dark brown median patches and usually three subapical dark brown spots, all of which are lacking in *parobifera* which is a much paler coloured species. In the male genitalia, the gnathus of *tyrannica* has a prominent median process which is absent in *parobifera*. *C. tyrannica* is distributed through East, Central and West Africa, with local differences in populations. Specimens from the south Sudan are paler in the fore wing than those from the Central African Republic and may be subspecifically distinct, but this decision needs longer series. The most distinct difference in a local population is found in East Africa where specimens have a lighter ground colour (still not as white as *parobifera*), and a more grey-brown general colour. The maculations on the East African specimens are more distinct than in the other specimens.

KEY TO THE SUBSPECIES OF *CECIDOTHYRIS TYRANNICA* sp. n.

1 Dark brown wing, with white circular patches . . . . . ***t. affinia*** (p. 183)
– Pale brown wing with yellow-brown circular patches . . . ***t. tyrannica*** (p. 182)

Cecidothyris tyrannica tyrannica ssp. n.

(Pl. 2, S; Pl. 47, fig. 269)

♂. Wing, 13–16·5 mm. Vertex brown, irrorate with white. Frons dome-shaped, strongly produced between eyes. Antennae strongly bipectinate. Labial palps short, just reaching

frons, second segment slightly longer than first. Thorax, tegulae, pale brown. Fore wing, pattern as in Pl. 2, S, brown with grey-white costal and basal areas. Anterior part of median area also grey-white. Reticulate pattern prominent, ground colour pale yellow-brown. Vein R_4 and R_5 stalked (R_3 and R_4 in some specimens). $1A$ and $2A$ start separately, joining 1/3 from base. Underside, darker than upperside, median area dark brown, three or four subapical dark brown spots in between veins. Hind wing, pattern and colour as fore wing. $Sc+R_1$ and Rs free.

GENITALIA ♂ (Pl. 47, fig. 269). Uncus simple. Gnathus with central peg-like projection. Juxta with two lateral lobes, each covered with short hairs. Aedeagus with minute spines on manica.

♀. Unknown.

DISCUSSION. There are two different arrangements of the radial veins in the fore wing in this subspecies. The three specimens from Ghana have R_4 and R_5 with a common stalk. The Sudan and Central African Republic specimens have R_3 and R_4 with a common stalk, but I can find no other differences between specimens of these two series. This variation in stalking of the radial veins is also found in the other subspecies. *C. t. tyrannica* can be separated from *C. t. affinia* by its yellow ground colour and reddish brown, rather than dark brown, colour. The pattern of the fore and hind wings of *C. t. affinia* consists of larger maculations which show more clearly than *C. t. affinia*.

DISTRIBUTION. Map 9. Ghana; Central African Republic; Sudan.

MATERIAL EXAMINED.

Holotype ♂, GHANA: N. Territories, Kete-Krachi (*Cardinall*), BM slide no. 9052, in BMNH.

Paratypes. GHANA: 2 ♂, data as type.

Material not included in the type-series, SUDAN: 2 ♂, Tambura, ix–x.1918; 2 ♂, Tambura, Southern Bahr-el-Ghazal; CENTRAL AFRICAN REPUBLIC: 10 ♂, Fort Crampel (*Le Moult*); 1 ♂, Oubanghi, 1920–32 (*de Joannis*).

Cecidothyris tyrannica affinia ssp. n.

(Pl. 2, R; Pl. 47, fig. 271)

♂. Wing, 15–18 mm. Structurally similar to the nominate subspecies. Distinguished by the darker brown colour and white (not yellow-brown) ground colour. Maculations more distinct than in the nominate subspecies (Pl. 2, R).

GENITALIA ♂ (Pl. 47, fig. 271). Similar to nominate subspecies. Vesica of aedeagus slightly less spinose.

♀. Unknown.

DISCUSSION. Specimens of this subspecies are much darker than the nominate one. It seems to replace the nominate one in East Africa.

DISTRIBUTION. Map 9. Uganda; Kenya.

MATERIAL EXAMINED.

Holotype ♂, UGANDA: Budongo, xi.1964 (*Brown*), BM slide no. 10306, in BMNH.

Paratypes. KENYA: 2 ♂, Kitale, iv–vi.1953 (*Howard*), one ♂ in NMK; 1 ♂, Kitale, 15.v.1925 (*Jeffery*), in TMP; 1 ♂, Mt Elgon, v.1932 (*Jackson*).

Cecidothyris longicorpa sp. n.

(Pl. 22, figs 119, 120; Pl. 47, fig. 270; Pl. 67, figs 436, 437)

♂. Wing, 13–15 mm. Vertex brown irrorate with white, frons brown. Antennae shortly ciliate. Labial palps short. Proboscis present. Thorax brown. Fore wing, pattern as in Pl. 22, figs 119, 120, brown with darker brown reticulations. Costal margin darker brown and dark spot in cell. Wings rather elongate, termen sharply angled. Veins R_4 and R_5 anastomose, R_3 and R_2 running close together, but not anastomosing. Hind wing, colour and pattern as fore wing. Apex of wing pointed, anterior margin convex. $Sc+R_1$ and Rs approach closely but do not join.

GENITALIA ♂ (Pl. 47, fig. 270). Uncus slender, thickened near apex. Gnathus reduced to two small lateral arms, not joining in mid-line. Basal process strongly sclerotized and pointed. Aedeagus with minute spines in vesica.

♀. Wing, 16–17 mm. Similar in colour to male but pattern slightly more obscure.

GENITALIA ♀ (Pl. 67, figs 436, 437). Anal papillae short, duct with narrowing, sclerotized part.

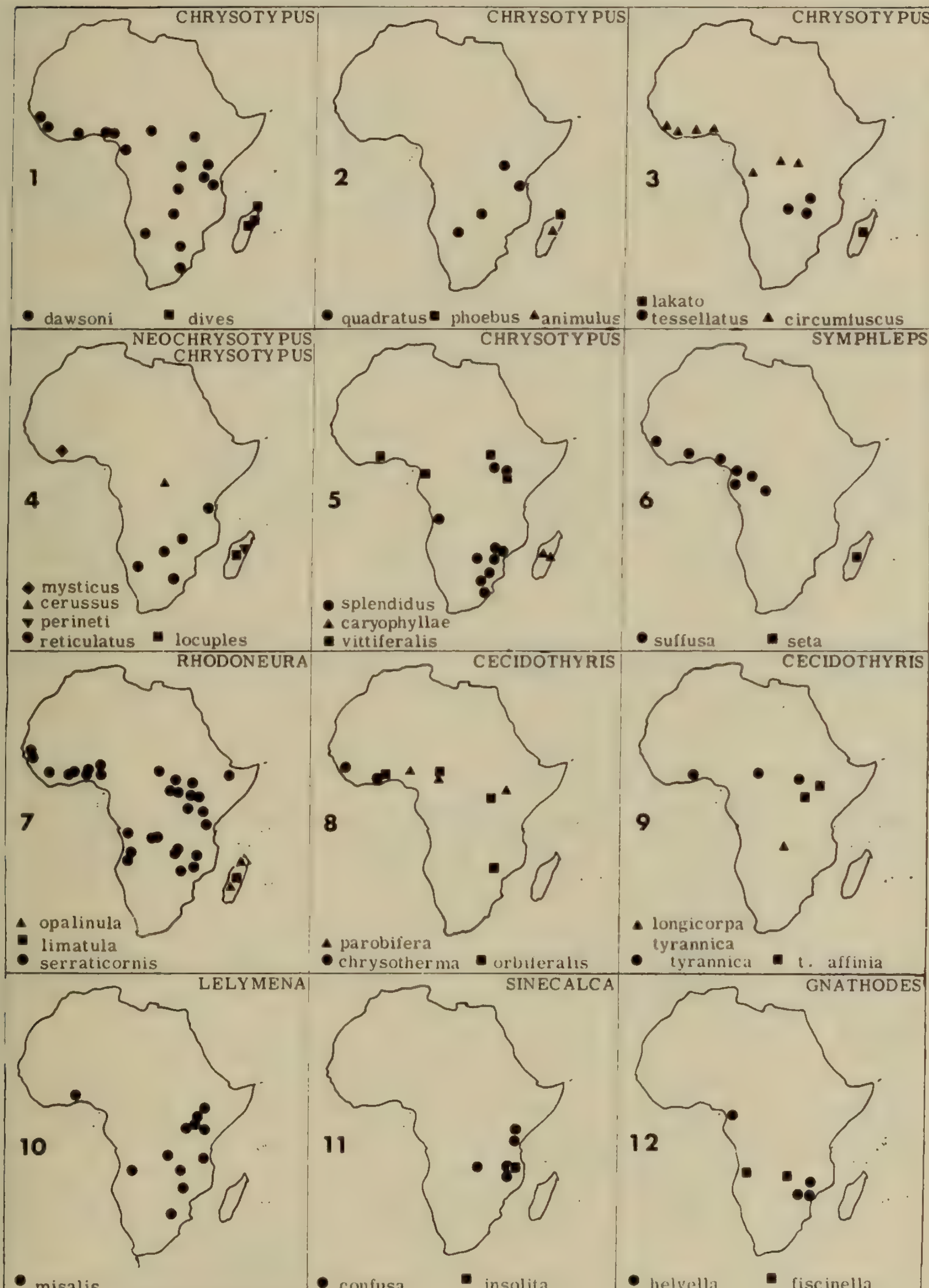
DISCUSSION. This species differs from all the others in the genus in the lack of the prominent pectinations on the antennae. The wing shape is also very different from the other species in the genus. In the other characters this species is quite typical of the genus. At present this species is known only from Central Africa and its relationship to the other species is not clear.

DISTRIBUTION. Map 9. Democratic Republic of the Congo.

MATERIAL EXAMINED.

Holotype ♂, DEMOCRATIC REPUBLIC OF THE CONGO: Katanga, Kolwezi, vii.1966, BM slide no. 10829, in BMNH.

Paratypes. DEMOCRATIC REPUBLIC OF THE CONGO: 2 ♀, Katanga, Kolwezi, ix.1964 (*Allard*); 2 ♀, Katanga, Kolwezi, 3.ix.1966, in NMR; 1 ♂, data as type; 3 ♂, Elisabethville (*Seydel*), 13–18.viii.1957, in MNHN.


CHRYSOTYPUS
1
dawsoni
dives
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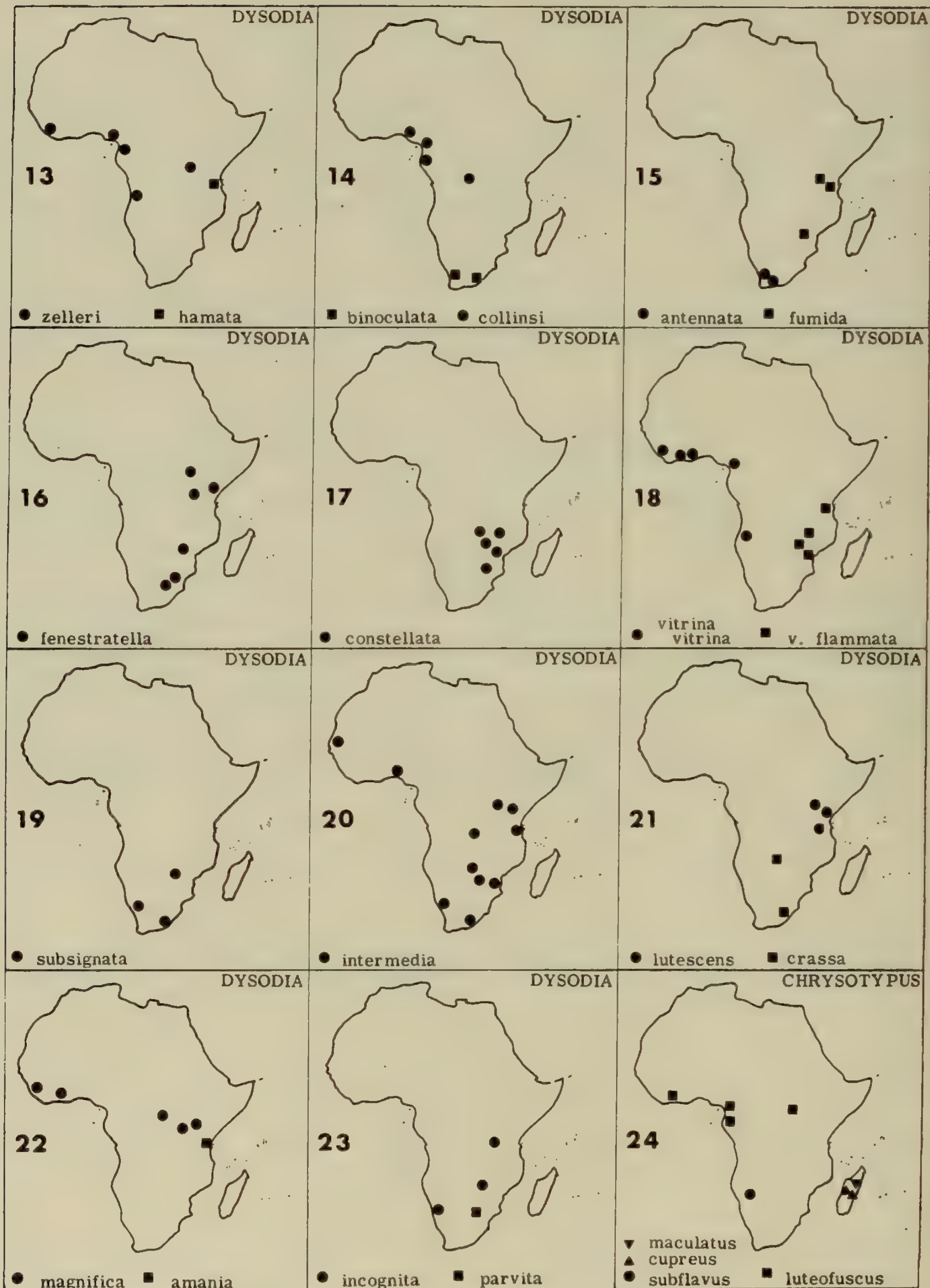
2
quadratus
phoebus
animulus
CHRYSOTYPUS
3
lakato
tessellatus
circumfuscus
NEOCHRYSOTYPUS
CHRYSOTYPUS
4
mysticus
cerussus
perineti
reticulatus
locuples
CHRYSOTYPUS
5
splendidus
caryophyllae
vittiferalis
SYMPHLEPS
6
suffusa
seta
RHODONEURA
7
opalinula
limatula
serraticornis
CECIDOTHYRIS
8
parobifera
chrysotherma
orbiferalis
CECIDOTHYRIS
9
longicorpa
tyrannica
tyrannica
t. affinia
LELYMENA
10
misalis
SINECALCA
11
confusa
insolita
GNATHODES
12
helvella
fiscinella


DYSODIA
13
zelleri
hamata
DYSODIA
14
binoculata
collinsi
DYSODIA
15
antennata
fumida
DYSODIA
16
fenestratella
DYSODIA
17
constellata
DYSODIA
18
vitrina vitrina
v. flammata
DYSODIA
19
subsignata
DYSODIA
20
intermedia
DYSODIA
21
lutescens
crassa
DYSODIA
22
magnifica
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23
incognita
parvita
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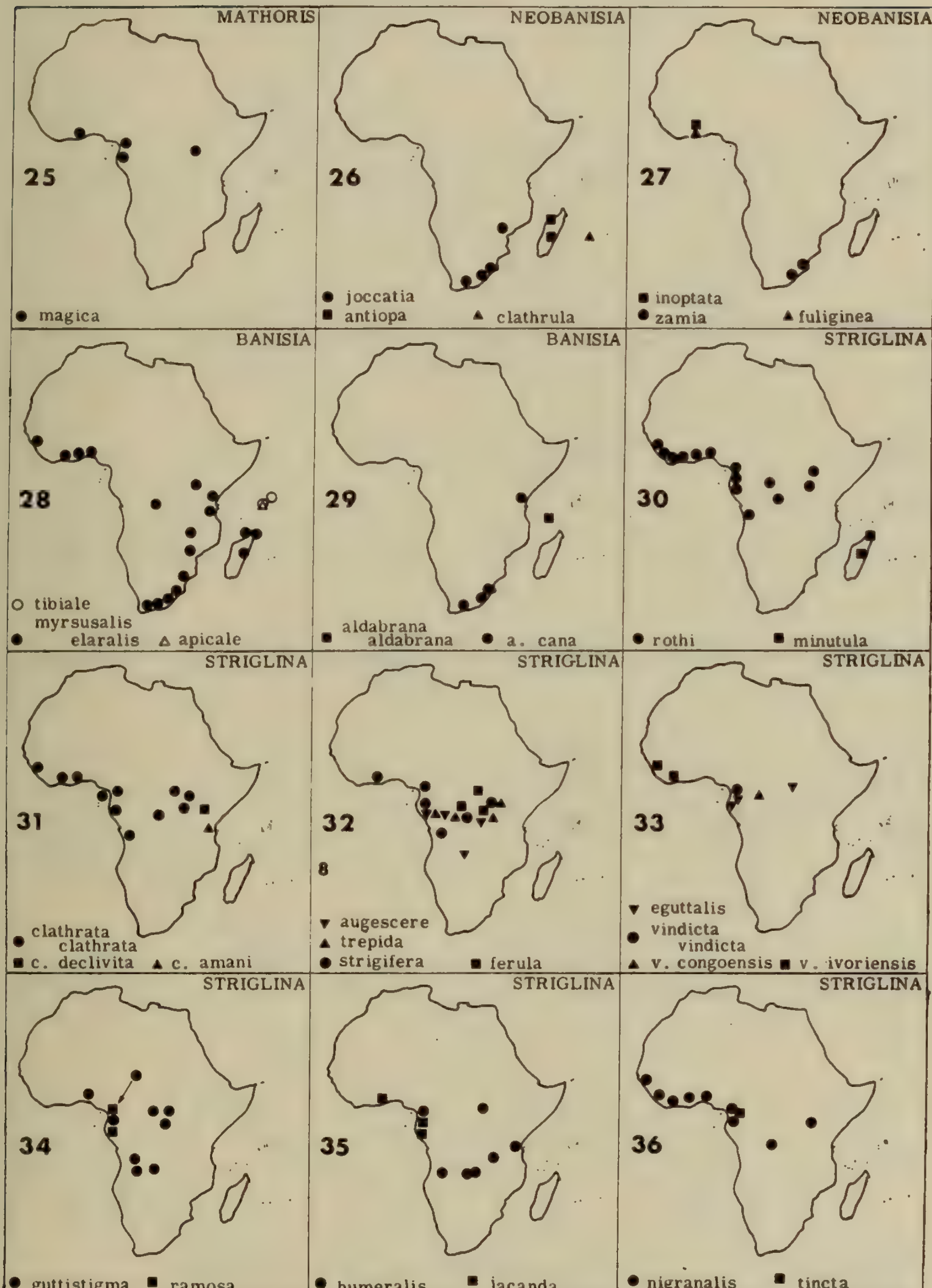
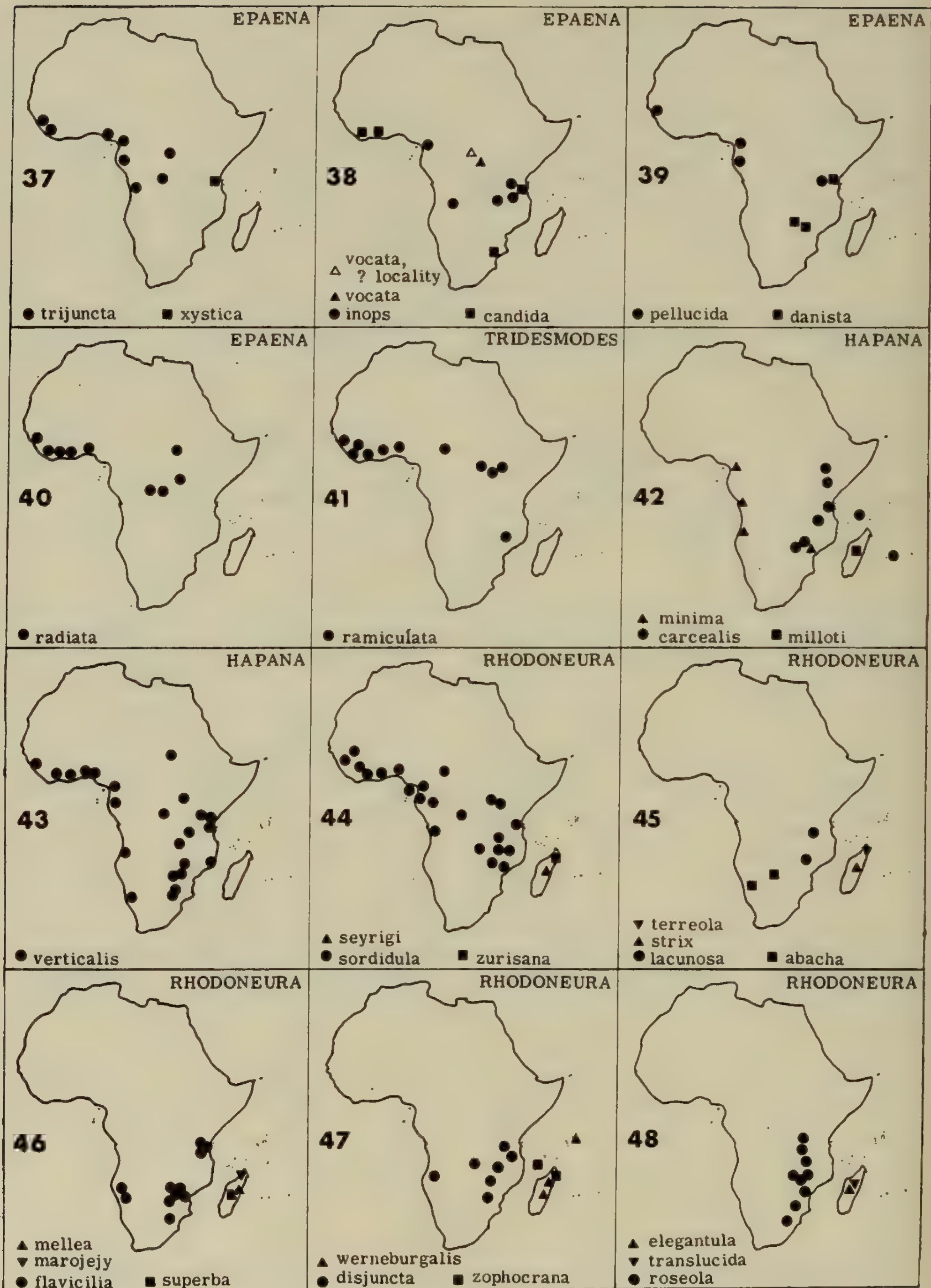
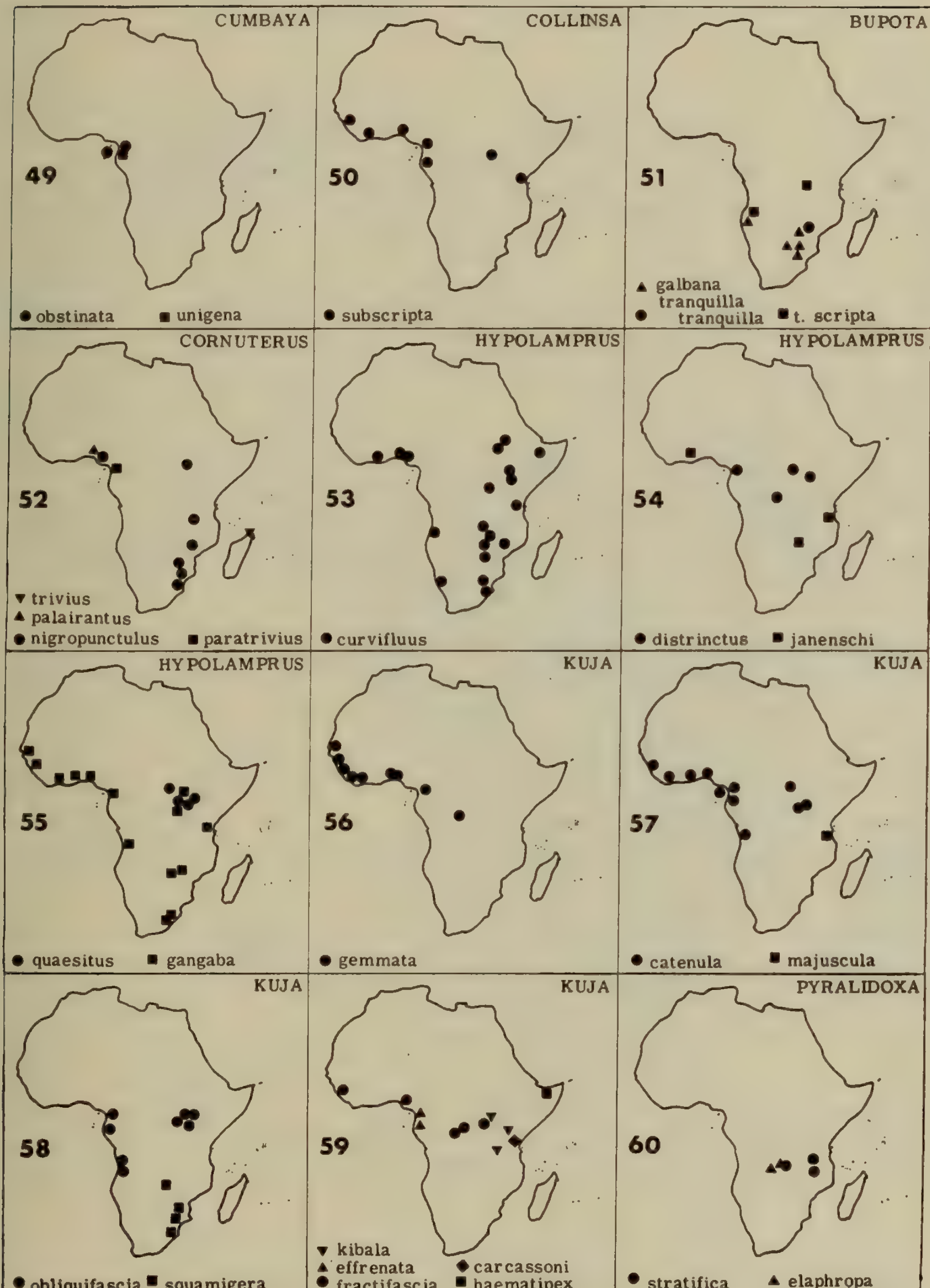
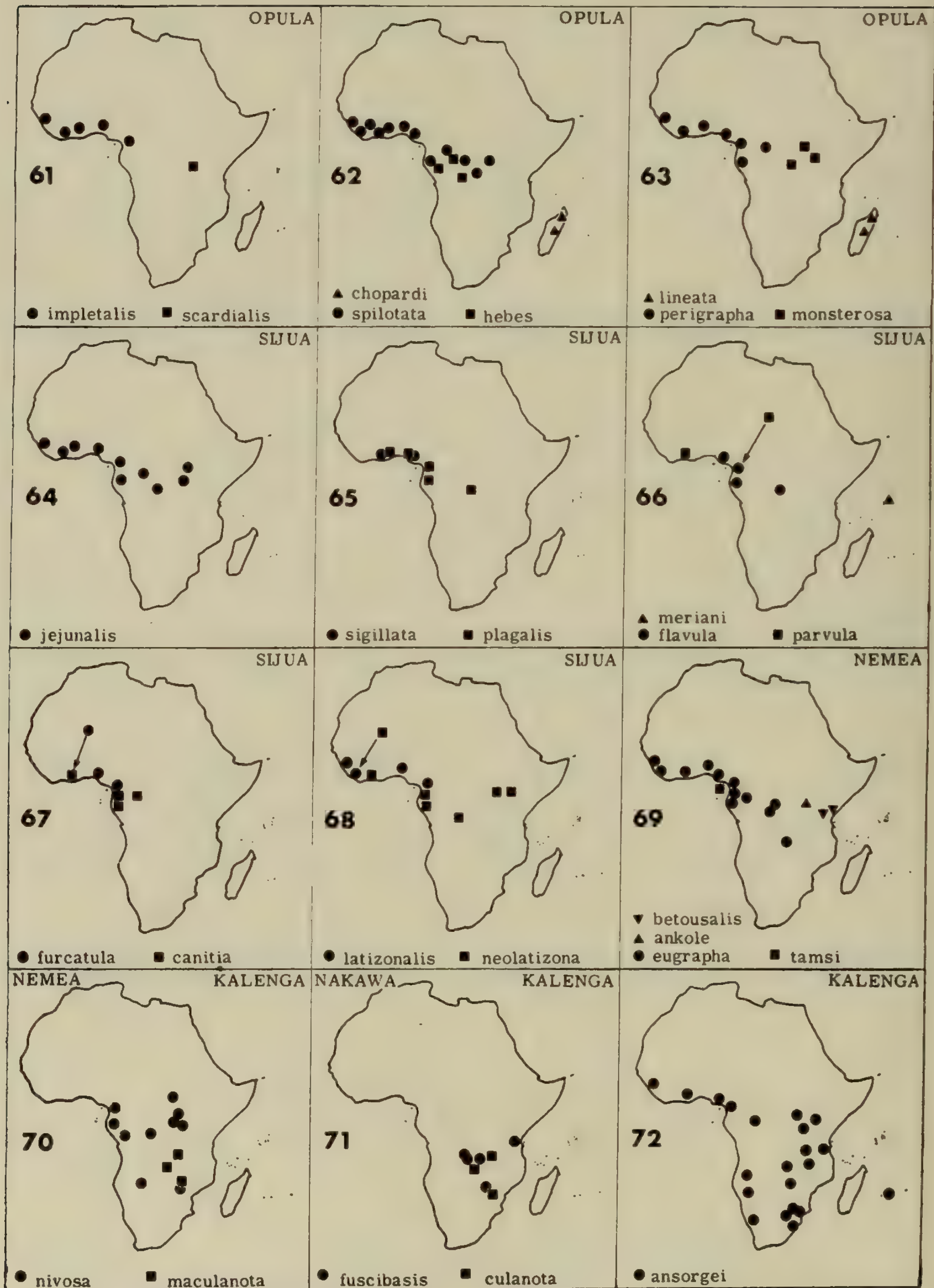
24
maculatus
cupreus
subflavus
luteofuscus

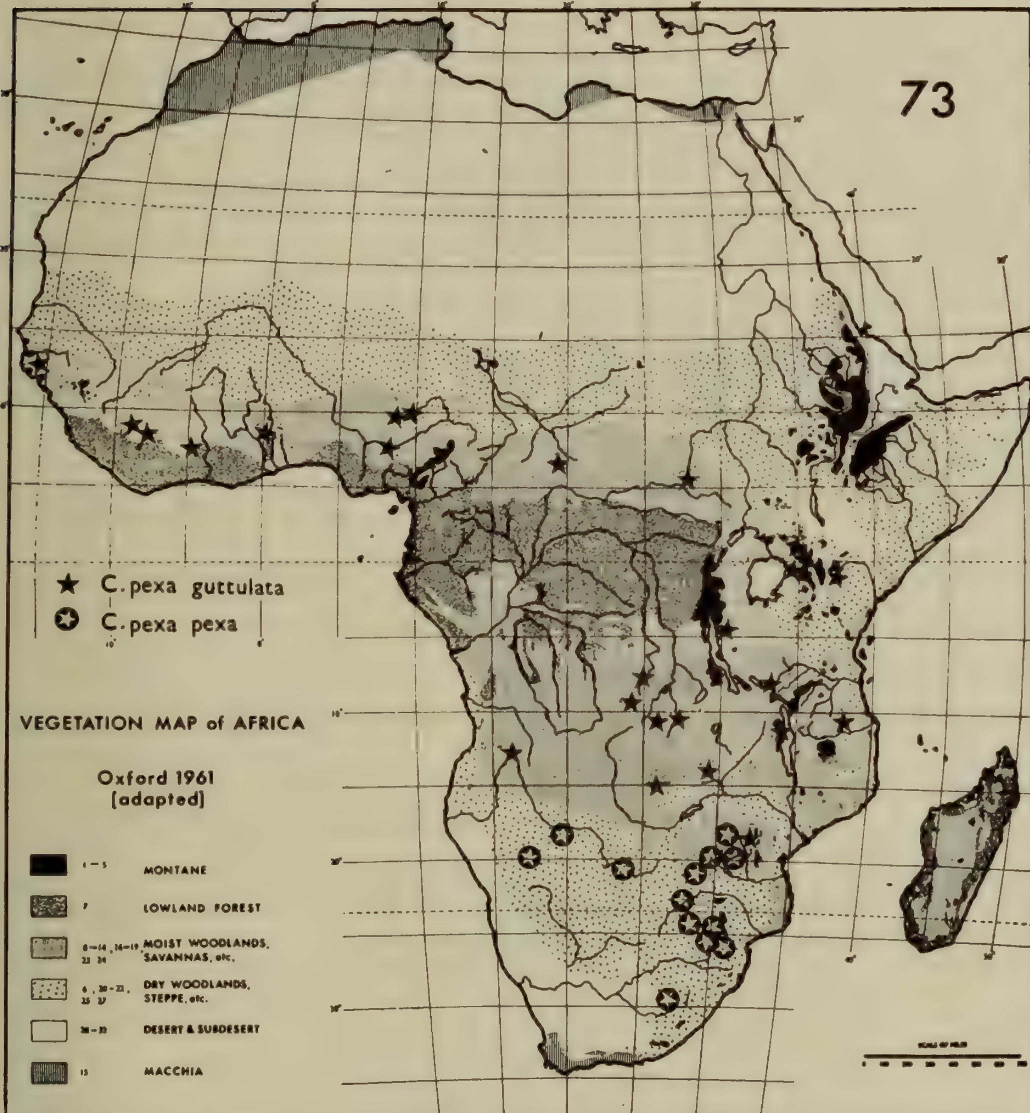


MATHORIS
25
magica
NEOBANISIA
26
joccatia
antiopa
clathrula
NEOBANISIA
27
inoptata
zamia
fuliginea
BANISIA
28
tibiale
myrsusalis
elaralis
apicale
BANISIA
29
aldabrana
aldabrana
a. cana
STRIGLINA
30
rothi
minutula
STRIGLINA
31
clathrata
clathrata
c. declivita
c. amani
STRIGLINA
32
augescere
trepida
strigifera
ferula
STRIGLINA
33
eguttalis
vindicta
vindicta
v. congoensis
v. ivoriensis
STRIGLINA
34
guttistigma
ramosa
STRIGLINA
35
humeralis
jacanda
STRIGLINA
36
nigranalis
tincta


EPAENA
37
● trijuncta ■ xystica
EPAENA
38
△ vocata, ? locality
▲ vocata
● inops ■ candida
EPAENA
39
● pellucida ■ danista
EPAENA
40
● radiata
TRIDESMODES
41
● ramiculata
HAPANA
42
▲ minima
● carcealis ■ milloti
HAPANA
43
● verticalis
RHODONEURA
44
▲ seyrigi
● sordidula ■ zurisana
RHODONEURA
45
▼ terreola
▲ strix
● lacunosa ■ abacha
RHODONEURA
46
▲ mellea
▼ marojejy
● flavicilia ■ superba
RHODONEURA
47
▲ werneburgalis
● disjuncta ■ zophocrana
RHODONEURA
48
▲ elegantula
▼ translucida
● roseola


CUMBAYA
49
● obstinata ■ unigena
COLLINSA
50
● subscripta
BUPOTA
51
▲ galbana tranquilla
● tranquilla ■ t. scripta
CORNUTERUS
52
▼ trivius
▲ palairantus
● nigropunctulus ■ paratrivius
HYPOLAMPRUS
53
● curvifluus
HYPOLAMPRUS
54
● distrinctus ■ janenschi
HYPOLAMPRUS
55
● quaesitus ■ gangaba
KUJA
56
● gemmata
KUJA
57
● catenula ■ majuscula
KUJA
58
● obliquifascia ■ squamigera
KUJA
59
▼ kibala
▲ effrenata ◆ carcassoni
● fractifascia ■ haematipex
PYRALIDOXA
60
● stratifica ▲ elaphropa


OPULA
61
● impletalis ■ scardialis
OPULA
62
▲ chopardi
● spilotata ■ hebes
OPULA
63
▲ lineata
● perigrapha ■ monsterosa
SIJUA
64
● jejunalis
SIJUA
65
● sigillata ■ plagalis
SIJUA
66
▲ meriani
● flavula ■ parvula
SIJUA
67
● furcatula ■ canitia
SIJUA
68
● latizonalis ■ neolatizona
NEMEA
69
▼ betousalis
▲ ankole
● eugrapha ■ tamsi
NEMEA KALENGA
70
● nivosa ■ maculanota
NAKAWA KALENGA
71
● fuscibasis ■ culanota
KALENGA
72
● ansorgei


73
★ C. pexa guttulata
✪ C. pexa pexa
VEGETATION MAP of AFRICA
Oxford 1961
[adapted]
MONTANE
LOWLAND FOREST
MOIST WOODLANDS, SAVANNAS, etc.
DRY WOODLANDS, STEPPE, etc.
DESERT & SUBDESERT
MACCHIA

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INDEX

(Synonyms in italics, main entry in **bold** figures)

P. E. S. Whalley, M.Sc.
Department of Entomology
British Museum (Natural History)
Cromwell Road
London, SW7 5BD

PLATE 1

A. *Bupota galbana* sp. n. ♂, paratype. Angola.
B. *Rhodoneura* (*R.*) *disjuncta* (Gaede). ♂, Dem. Rep. of the Congo.
C. *Rhodoneura* (*R.*) *roseola* sp. n. ♀, paratype. Rhodesia.
D. *Banisia aldabrana cana* ssp. n. ♂, paratype. S. Africa.
E. *Banisia aldabrana aldabrana* (Fryer). ♀. Aldabra.
F. *Hapana carcealis* sp. n. ♂, paratype. Kenya.
G. *Neobanisia inoptata* sp. n. ♀, paratype. Ghana.
H. *Dysodia vitrina vitrina* (Boisduval). ♂. Cameroon.
I. *Dysodia vitrina flammata* Bethune-Baker. ♀. Malawi.
J. *Dysodia constellata* Warren. ♀. S. Africa.
K. *Dysodia fenestratella* Warren. ♂. S. Africa.
L. *Kalenga maculanota* sp. n. ♂, paratype. Zambia.
M. *Striglina clathrata clathrata* Hampson. ♂. Cameroon.
N. *Striglina clathrata amani* ssp. n. ♂, paratype. Tanzania.
O. *Striglina clathrata declivita* ssp. n. ♀, paratype. Kenya.
P. *Striglina rothi* Warren. ♀. Cameroon.
Q. *Striglina rothi* Warren. ♂. Sierra Leone.
R. *Rhodoneura* (*R.*) *flavicilia* Hampson. ♀. Rhodesia.


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PLATE 2

A. *Nakawa fuscibasis* (Hampson). ♀. Zambia.
B. *Rhodoneura* (*R.*) *lacunosa* sp. n. ♂, paratype. Rhodesia.
C. *Rhodoneura* (*R.*) *sordidula* (Plötz). ♂. Rhodesia.
D. *Rhodoneura* (*R.*) *zurisana* sp. n. ♂, paratype. Madagascar.
E. *Rhodoneura* (*I.*) *serraticornis* (Warren). ♂, Group A. Rep. of Guinea.
F. *Rhodoneura* (*I.*) *serraticornis* (Warren). ♂, Group A. Angola.
G. *Striglina nigranalis* (Warren). ♂. Ivory Coast.
H. *Banisia myrsusalis elaralis* (Walker). ♂. Tanzania.
I. *Chrysotypus subflavus* sp. n. ♂, paratype. SW. Africa.
J. *Chrysotypus quadratus* sp. n. ♂, paratype. Kenya.
K. *Rhodoneura* (*R.*) *superba* Viette. ♂. Magadascar.
L. *Lelymena misalis* Karsch. ♀. Kenya.
M. *Striglina humeralis* sp. n. ♂, paratype. Tanzania.
N. *Cecidothyris pexa pexa* (Hampson). ♀. S. Africa.
O. *Cecidothyris pexa guttulata* Aurivillius. ♂. Ghana.
P. *Cecidothyris orbiferalis* (Gaede). ♀. Ghana.
Q. *Cecidothyris parobifera* sp. n. ♂, paratype. Kenya.
R. *Cecidothyris tyrannica affinia* ssp. n. ♂, paratype. Kenya.
S. *Cecidothyris tyrannica tyrannica* ssp. n. ♂, paratype. Ghana.
T. *Epaena radiata* (Warren). ♂. Nigeria.


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PLATE 3

FIG. 1. *Chrysotypus dawsoni* Distant.
FIG. 2. *Chrysotypus dawsoni* Distant.
FIG. 3. *Chrysotypus tessellatus* (Warren).
FIG. 4. *Chrysotypus circumfuscus* sp. n.
FIG. 5. *Chrysotypus reticulatus* sp. n.
FIG. 6. *Chrysotypus luteofuscus* sp. n.

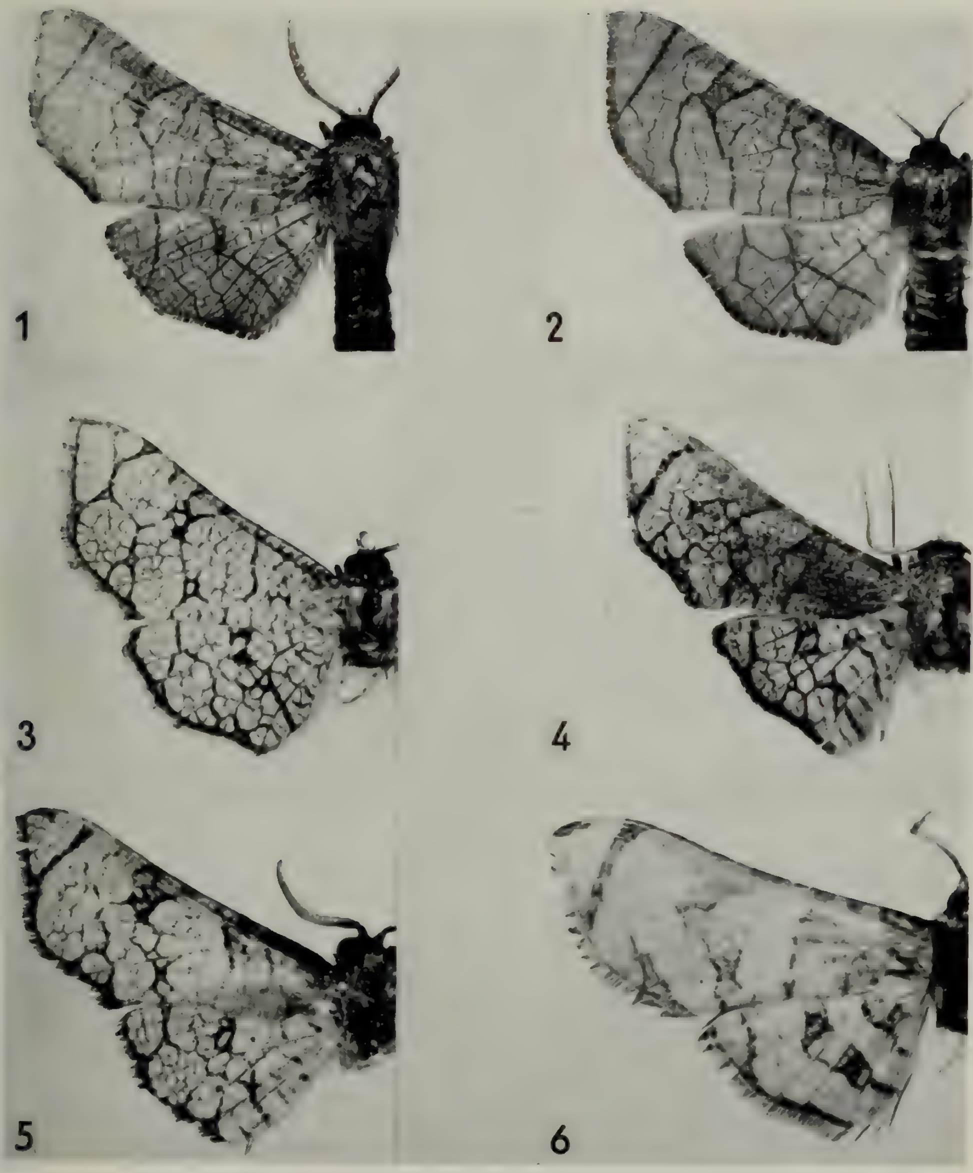
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PLATE 4

FIG. 7. *Chrysotypus splendidus* (Warren).
FIG. 8. *Chrysotypus splendidus* (Warren).
FIG. 9. *Chrysotypus vittiferalis* (Gaede).
FIG. 10. *Neochrysotypus cerussus* sp. n.
FIG. 11. *Dysodia parvita* sp. n.
FIG. 12. *Dysodia parvita* sp. n.

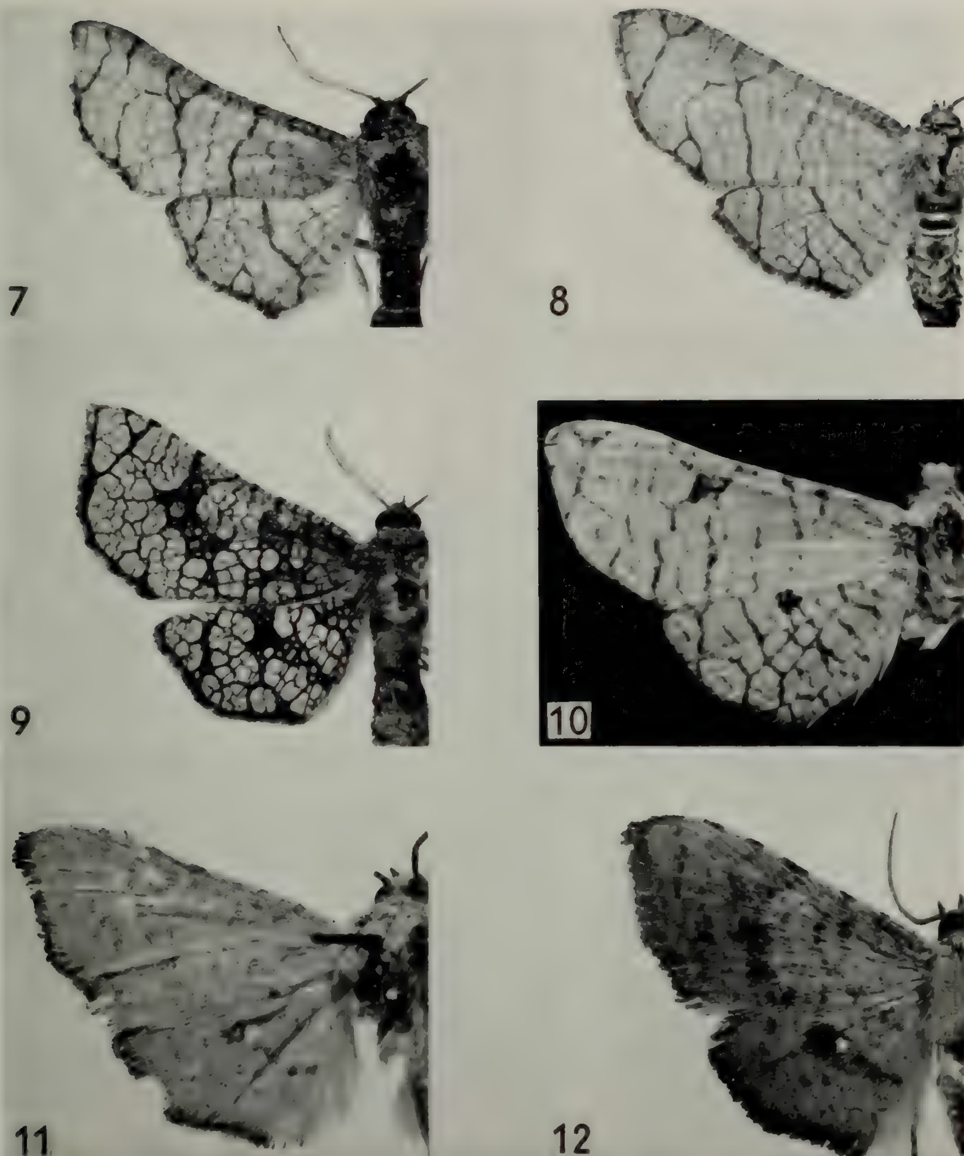
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PLATE 5

FIG. 13. *Mathoris magica* Gaede.
FIG. 14. *Mathoris magica* Gaede.
FIG. 15. *Dysodia magnifica* Whalley.
FIG. 16. *Neobanisia fuliginea* sp. n.
FIG. 17. *Neobanisia clathrula* (Guenée).
FIG. 18. *Neobanisia clathrula* (Guenée).


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PLATE 6

FIG. 19. *Neobanisia zamia* sp. n.
FIG. 20. *Neobanisia zamia* sp. n.
FIG. 21. *Banisia apicale* (Fryer).
FIG. 22. *Neobanisia joccatia* sp. n.
FIG. 23. *Banisia tibiale* (Fryer).
FIG. 24. *Striglina eguttalis* Gaede.

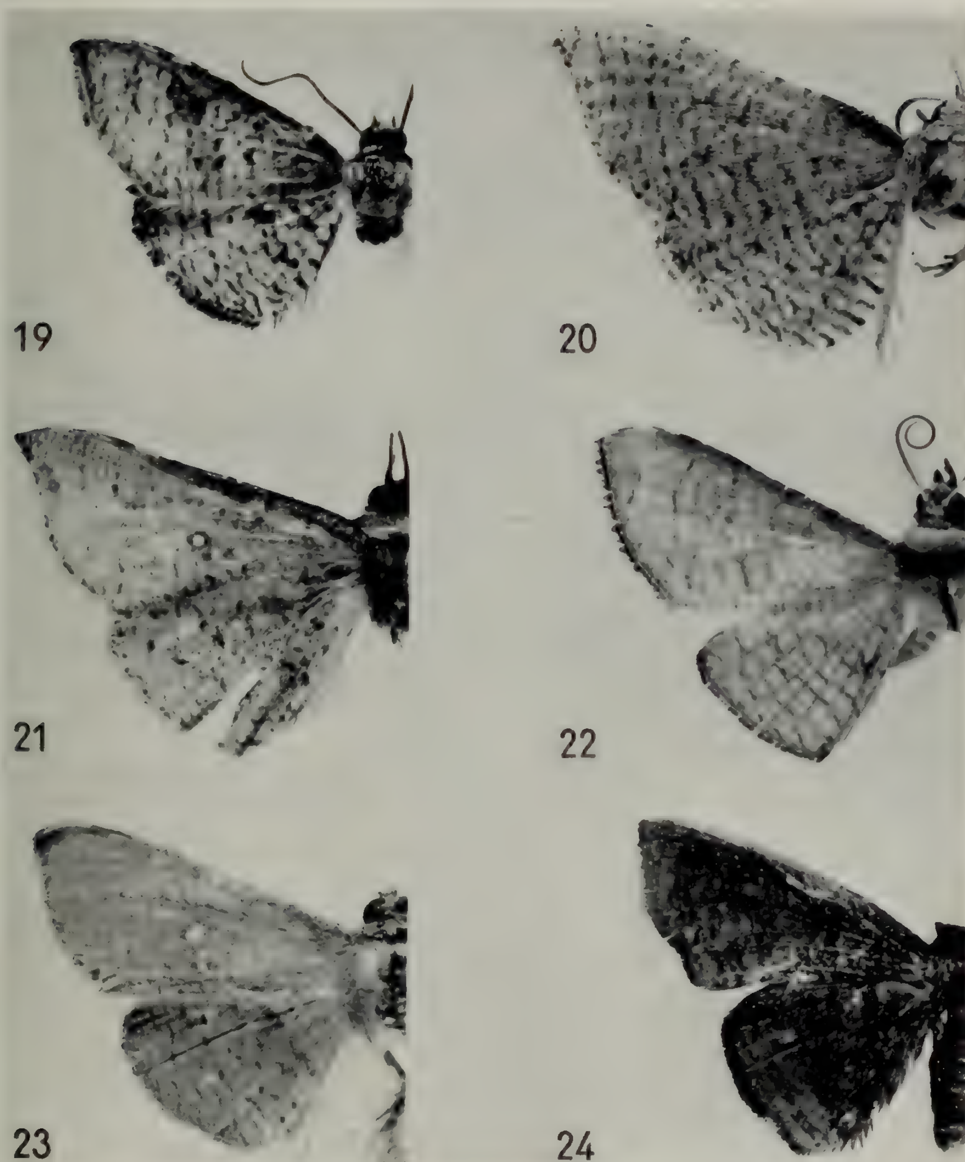
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PLATE 7

FIG. 25. *Striglina vindicta vindicta* ssp. n.
FIG. 26. *Striglina vindicta ivoriensis* ssp. n.
FIG. 27. *Striglina vindicta congoensis* ssp. n.
FIG. 28. *Striglina ramosa* sp. n.
FIG. 29 *Striglina tincta* sp. n.
FIG. 30. *Striglina jacanda* sp. n.

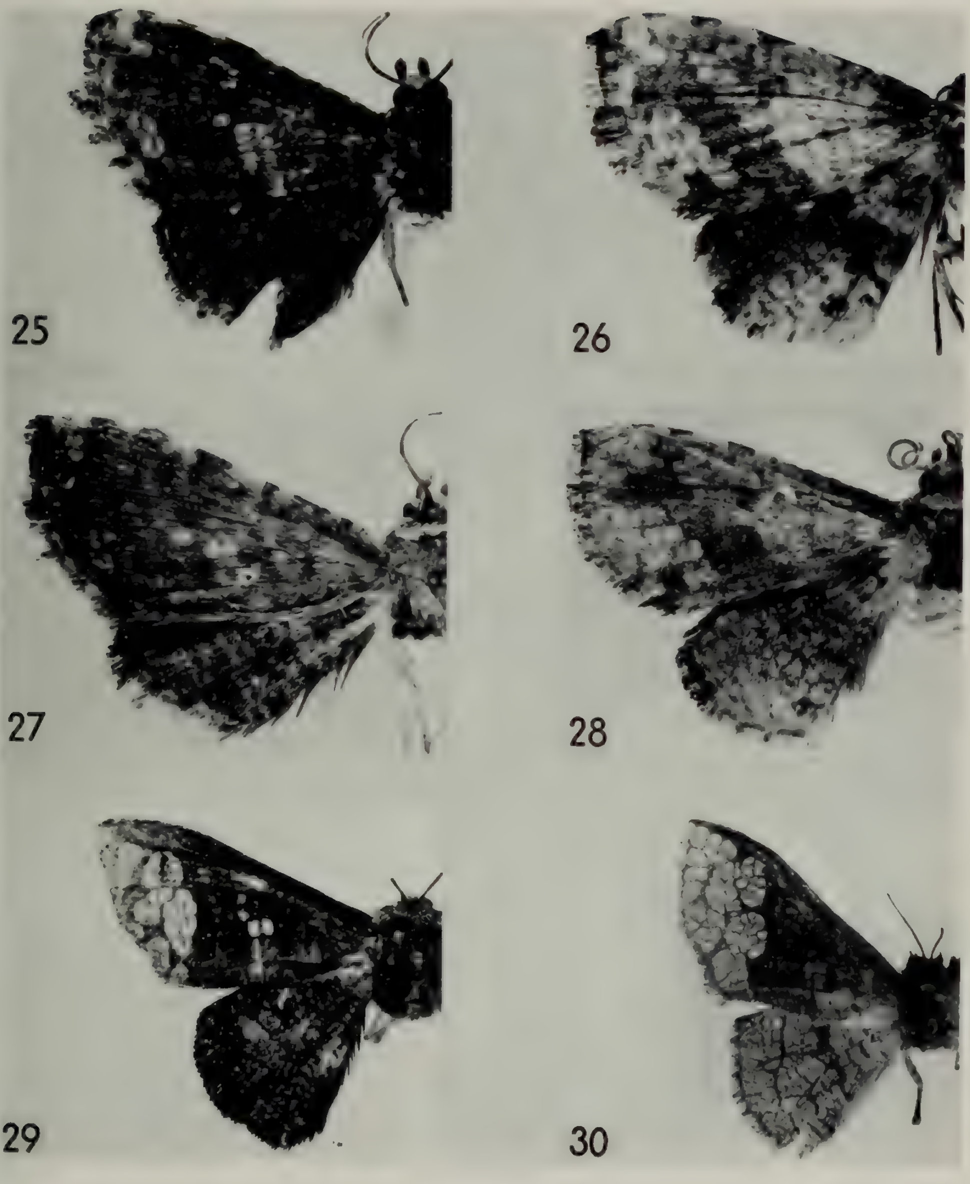

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PLATE 8

FIG. 31. *Striglina strigifera* Strand.
FIG. 32. *Striglina ferula* sp. n.
FIG. 33. *Striglina augescere* sp. n.
FIG. 34. *Striglina trepida* sp. n.
FIG. 35. *Striglina guttistigma* Hampson.
FIG. 36. *Symphleps suffusa* Warren.

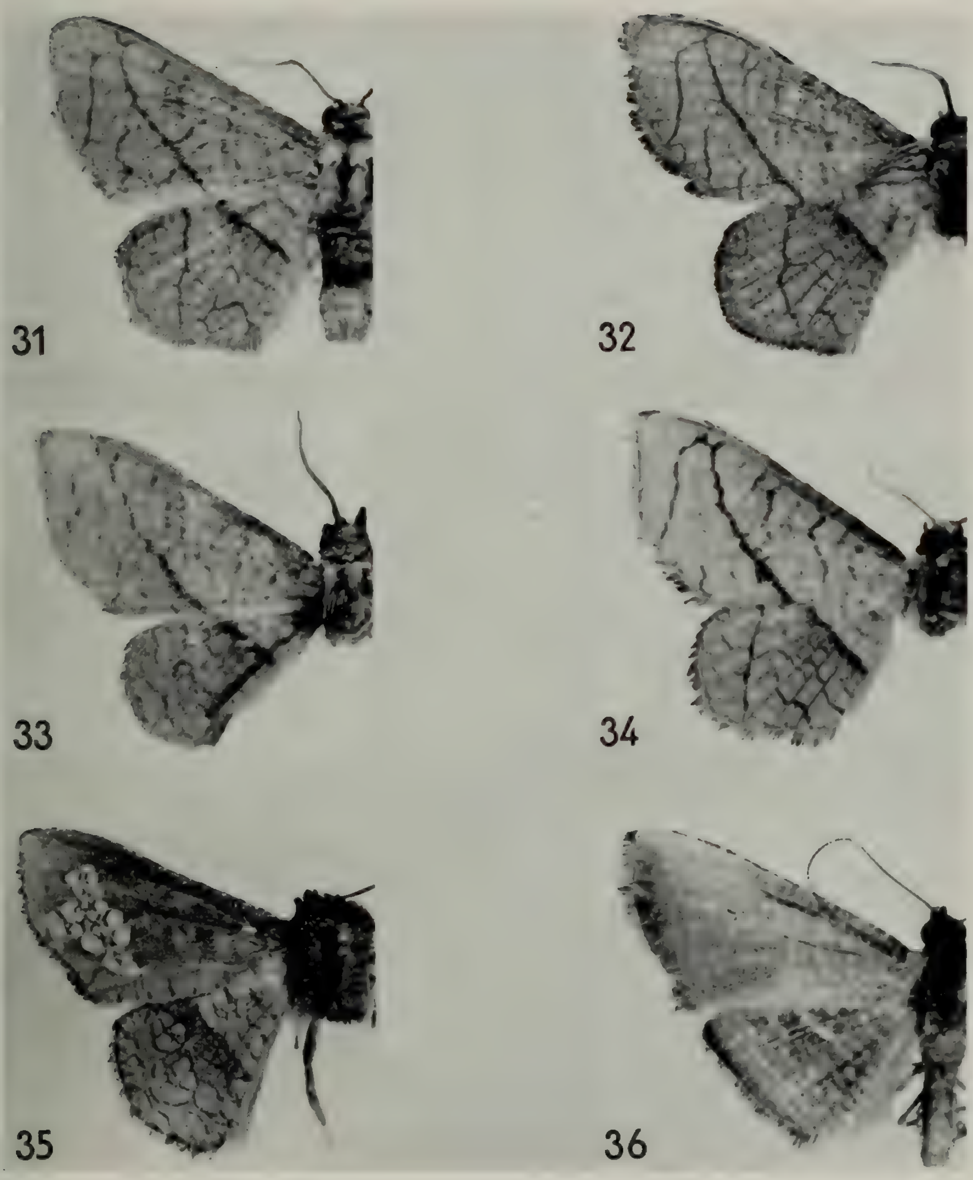
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PLATE 9

FIG. 37. *Rhodoneura* (*Isothauma*) *serraticornis* (Warren).
FIG. 38. *Rhodoneura* (*Isothauma*) *serraticornis* (Warren).
FIG. 39. *Rhodoneura* (*Isothauma*) sp. near *zophocrana* Viette.
FIG. 40. *Rhodoneura* (*Isothauma*) sp. near *zophocrana* Viette.
FIG. 41. *Rhodoneura* (*Rhodoneura*) *flavicilia* Hampson.
FIG. 42. *Rhodoneura* (*Rhodoneura*) *abacha* sp. n.

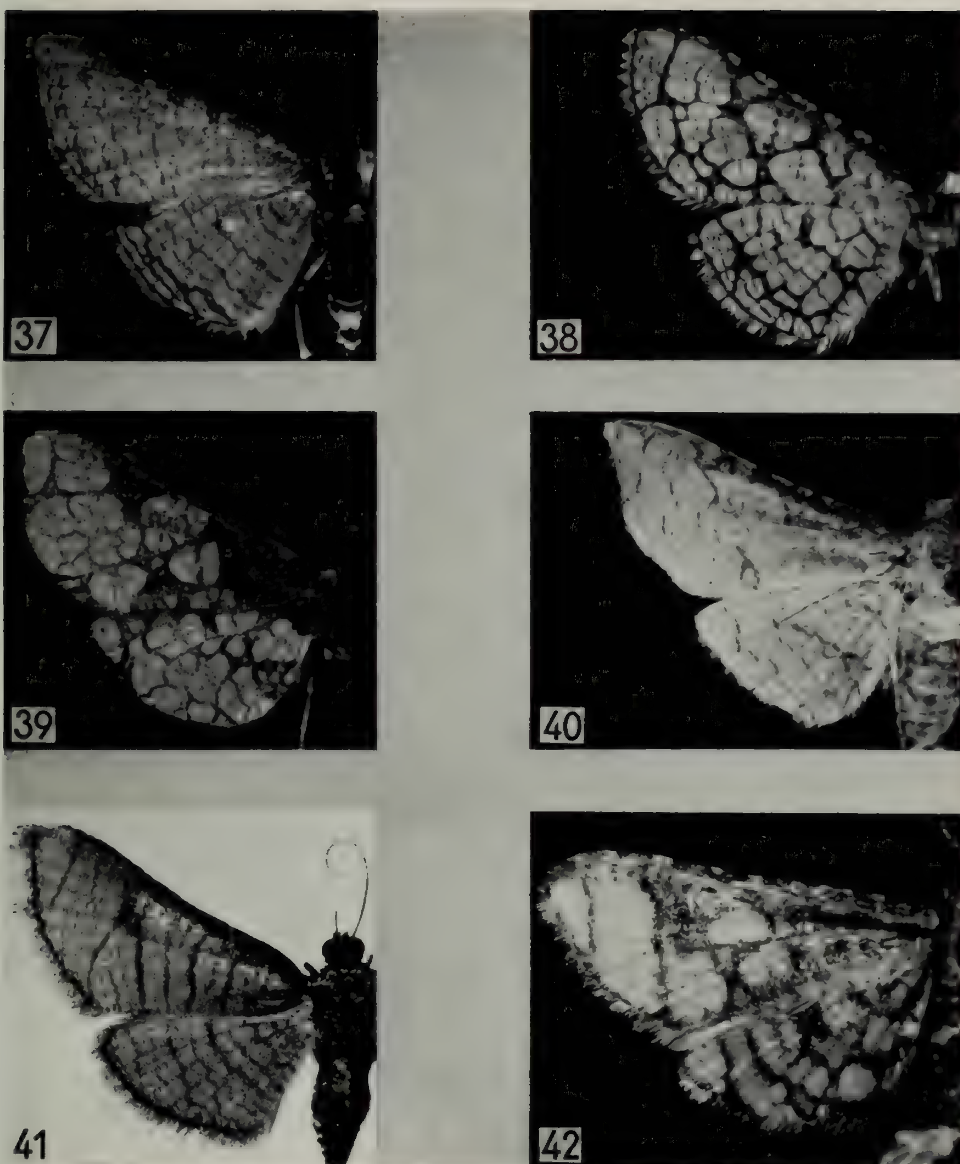
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PLATE 10

FIG. 43. *Hapana verticalis* (Warren).
FIG. 44. *Hapana carcealis* sp. n.
FIG. 45. *Hapana minima* sp. n.
FIG. 46. *Tridesmodes ramiculata* Warren.
FIG. 47. *Pyralidoxa elaphropa* (Meyrick).
FIG. 48. *Pyralidoxa stratifica* Meyrick.

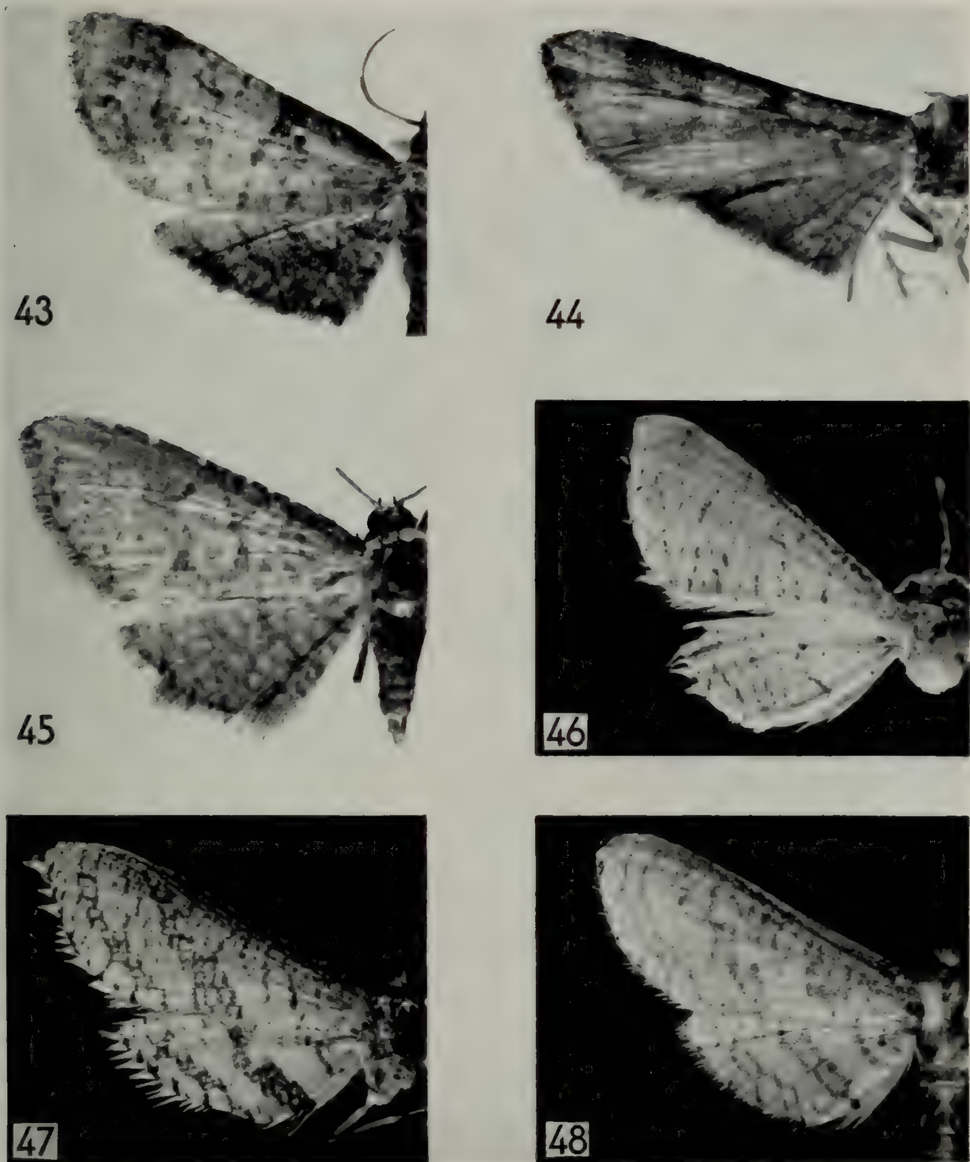
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PLATE 11

FIG. 49. *Epaena trijuncta* (Warren).
FIG. 50. *Epaena trijuncta* (Warren).
FIG. 51. *Epaena inops* (Gaede).
FIG. 52. *Epaena candida* sp. n.
FIG. 53. *Epaena pellucida* sp. n.
FIG. 54. *Epaena danista* sp. n.


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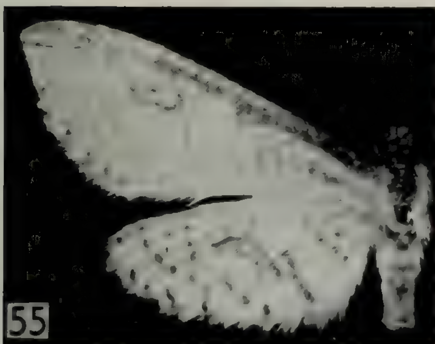
PLATE 12

FIG. 55. *Epaena xystica* sp. n.
FIG. 56. *Epaena vocata* sp. n.
FIG. 57. *Kuja catenula* (Pagenstecher) (Underside).
FIG. 58. *Kuja catenula* (Pagenstecher).
FIG. 59. *Kuja gemmata* (Hampson).
FIG. 60. *Kuja gemmata* (Hampson) (Underside).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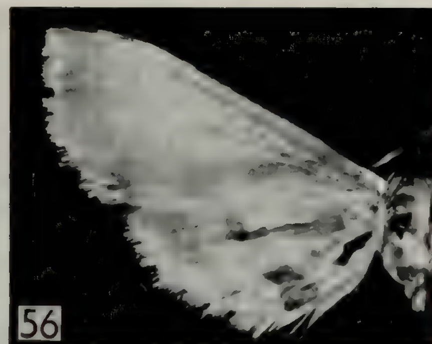
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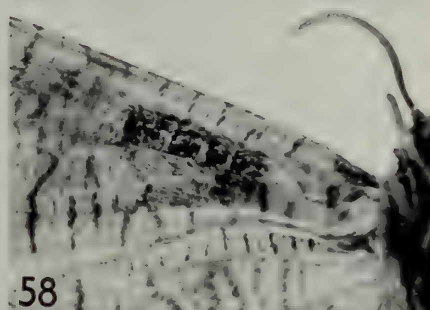
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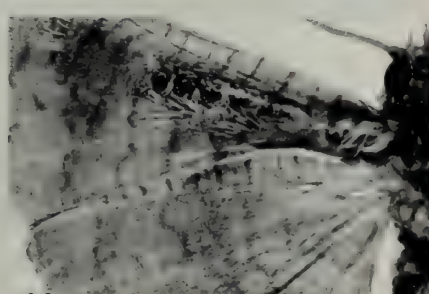
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PLATE 13

FIG. 61. *Kuja obliquifascia* (Warren).
FIG. 62. *Kuja obliquifascia* (Warren) (Underside).
FIG. 63. *Kuja squamigera* (Pagenstecher).
FIG. 64. *Kuja squamigera* (Pagenstecher) (Underside).
FIG. 65. *Kuja fractifascia* (Warren).
FIG. 66. *Kuja fractifascia* (Warren) (Underside).

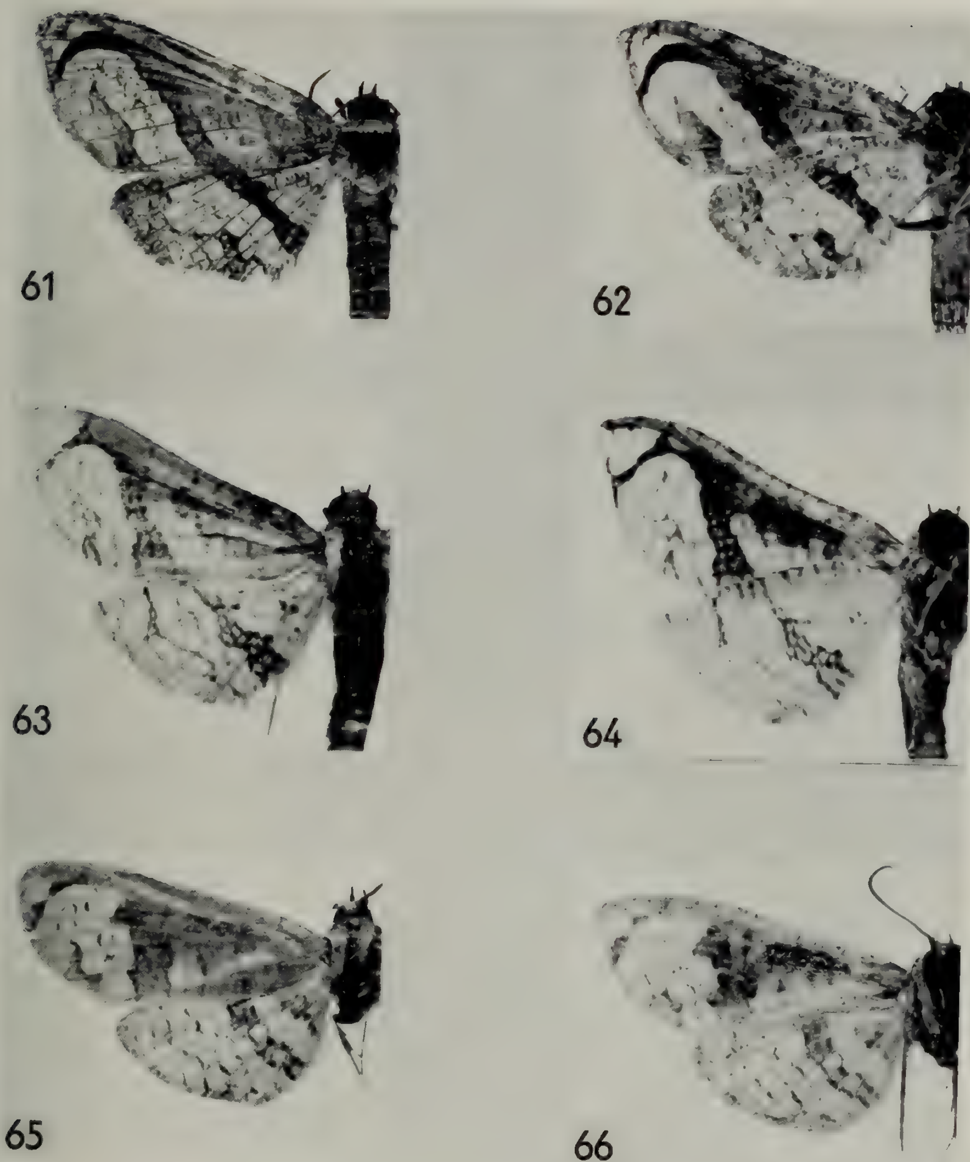
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PLATE 14

FIG. 67. *Kuja hamatipex* (Hampson).
FIG. 68. *Kuja effrenata* sp. n.
FIG. 69. *Kuja kibala* sp. n.
FIG. 70. *Kuja carcassoni* sp. n. (Photo D. J. Carter).
FIG. 71. *Bupota tranquilla tranquilla* ssp. n.
FIG. 72. *Bupota tranquilla scripta* ssp. n.

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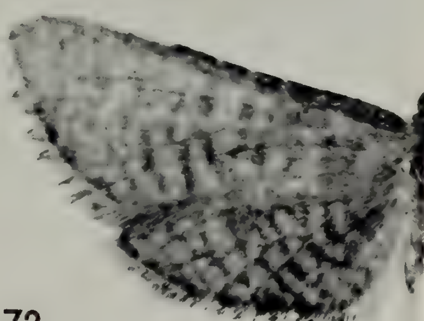

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PLATE 15

Fig. 73. *Hypolamprus curvifluus* (Warren). (Rhodesia).
Fig. 74. *Hypolamprus curvifluus* (Warren). (Kenya).
Fig. 75. *Hypolamprus janeneschi* (Gaede).
Fig. 76. *Hypolamprus janeneschi* (Gaede).
Fig. 77. *Hypolamprus distrinctus* sp. n.
Fig. 78. *Hypolamprus gangaba* sp. n.

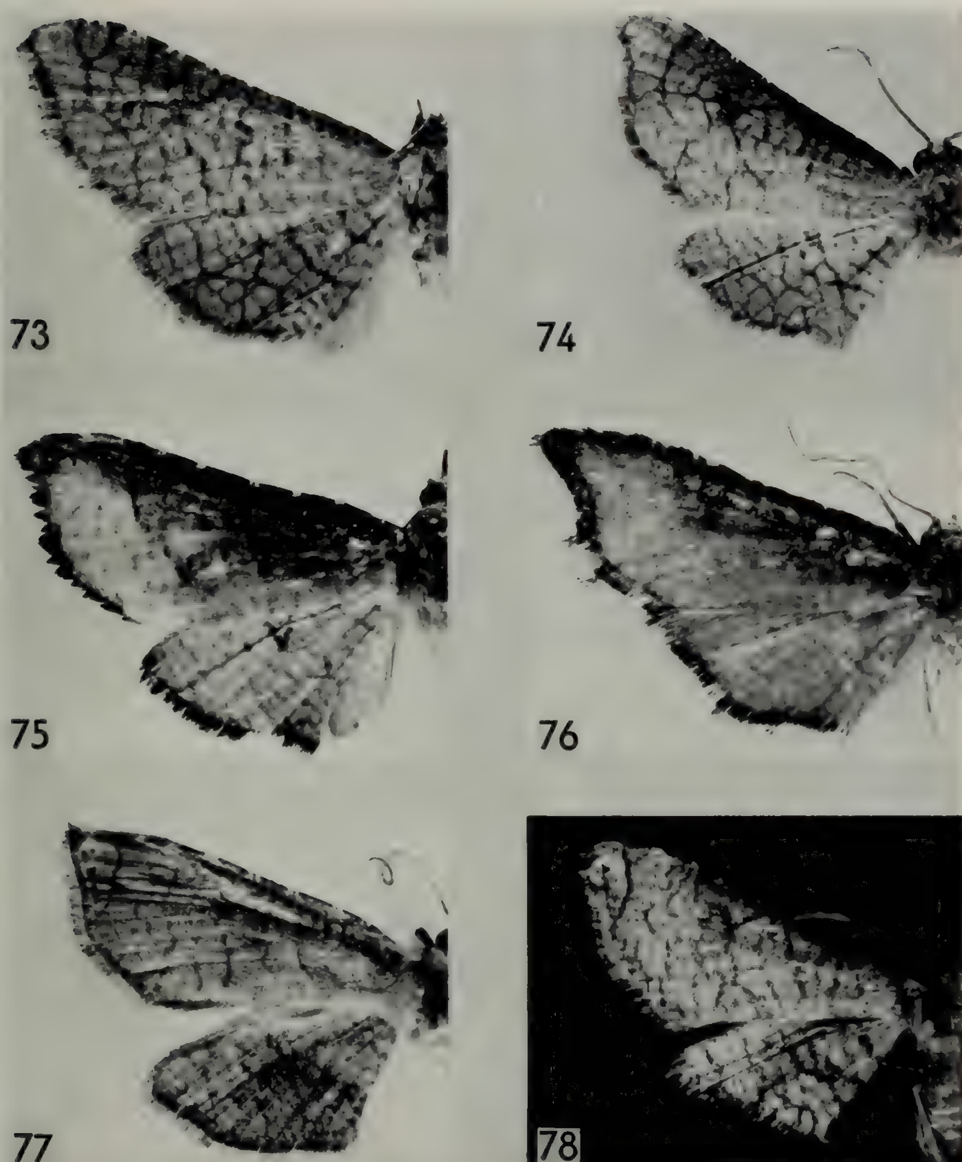
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PLATE 16

FIG. 79. *Hypolamprus quaesitus* sp. n.
FIG. 80. *Cornuterus paratrivius* sp. n.
FIG. 81. *Cornuterus palairantus* Bethune-Baker.
FIG. 82. *Cornuterus nigropunctulus* (Pagenstecher).
FIG. 83. *Collinsa subscripta* (Warren).
FIG. 84. *Collinsa subscripta* (Warren).

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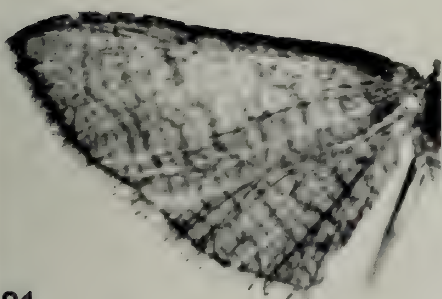

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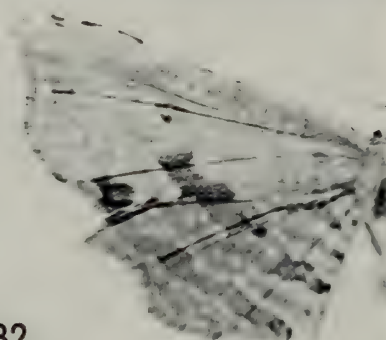

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PLATE 17

FIG. 85. *Cumbaya unigena* sp. n.
FIG. 86. *Cumbaya obstinata* sp. n.
FIG. 87. *Kalenga ansorgei* (Warren).
FIG. 88. *Kalenga ansorgei* (Warren).
FIG. 89. *Kalenga culanota* sp. n.
FIG. 90. *Nakawa fulvipicta* (Hampson).

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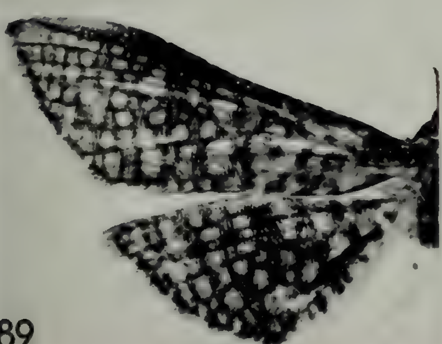

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PLATE 18

FIG. 91. *Nemea eugrapha* (Hampson).
FIG. 92. *Nemea tamsi* sp. n.
FIG. 93. *Nemea nivosa* sp. n.
FIG. 94. *Nemea ankole* sp. n.
FIG. 95. *Nemea betousalis* (Gaede), ♂.
FIG. 96. *Nemea betousalis* (Gaede), ♀.

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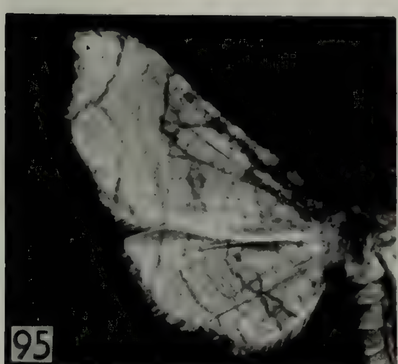

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PLATE 19

FIG. 97. *Sijua jejunalis* (Gaede).
FIG. 98. *Sijua jejunalis* (Gaede).
FIG. 99. *Sijua sigillata* (Warren).
FIG. 100. *Sijua sigillata* (Warren).
FIG. 101. *Sijua plagalis* (Gaede).
FIG. 102. *Sijua plagalis* (Gaede).


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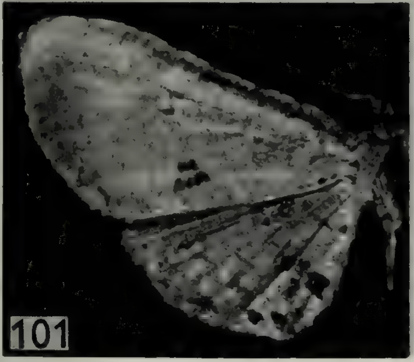
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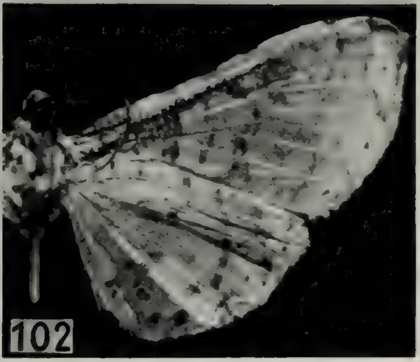
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PLATE 20

FIG. 103. *Sijua flavula* (Pagenstecher).
FIG. 104. *Sijua furcatula* (Pagenstecher).
FIG. 105. *Sijua parvula* sp. n.
FIG. 105a. *Sijua meriani* (Gaede). (This is 1/2 the magnification of Fig. 105.)
FIG. 106. *Sijua neolatizona* sp. n.
FIG. 107. *Sijua canitia* sp. n.
FIG. 108. *Sijua latizonalis* Hampson.

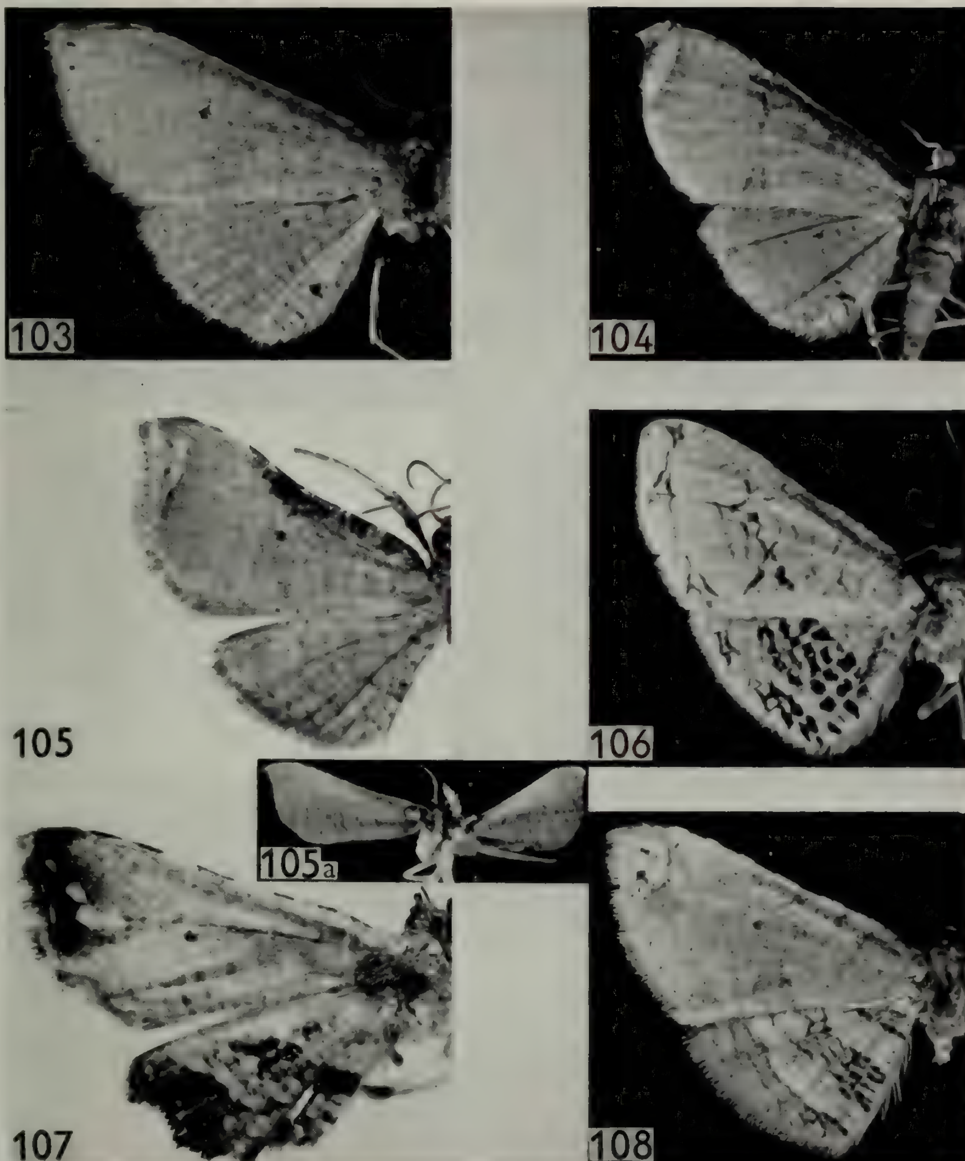
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PLATE 21

FIG. 109. *Opula impletalis* (Walker).
FIG. 110. *Opula perigrapha* (Hampson).
FIG. 111. *Opula spilotata* (Warren).
FIG. 112. *Opula scardialis* (Rebel).
FIG. 113. *Opula hebes* sp. n.
FIG. 114. *Opula monsterosa* sp. n.

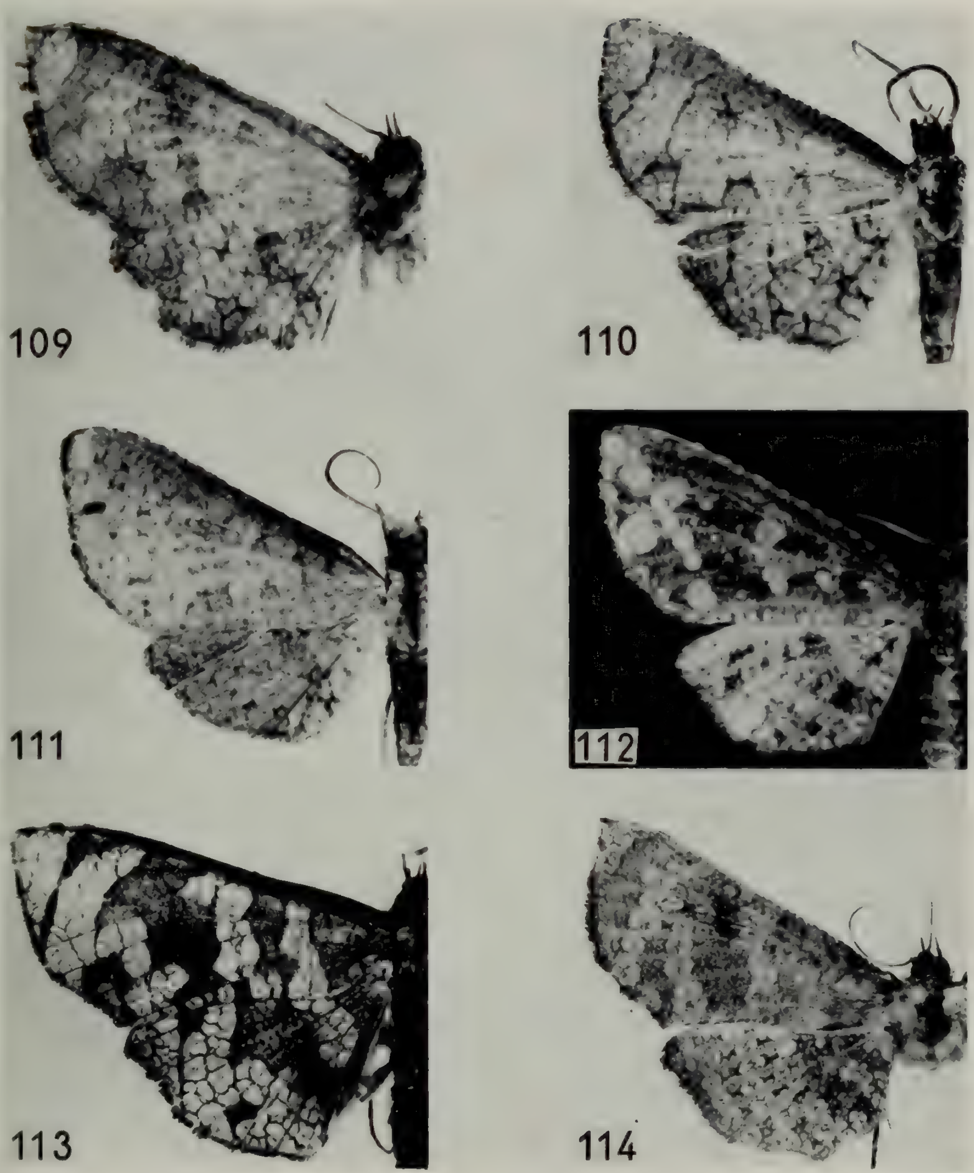
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PLATE 22

FIG. 115. *Gnathodes helvella* sp. n.
FIG. 116. *Gnathodes fiscinella* sp. n.
FIG. 117. *Sinecalca insolita* sp. n.
FIG. 118. *Sinecalca confusa* sp. n.
FIG. 119. *Cecidothyris longicorpa* sp. n.
FIG. 120. *Cecidothyris longicorpa* sp. n.

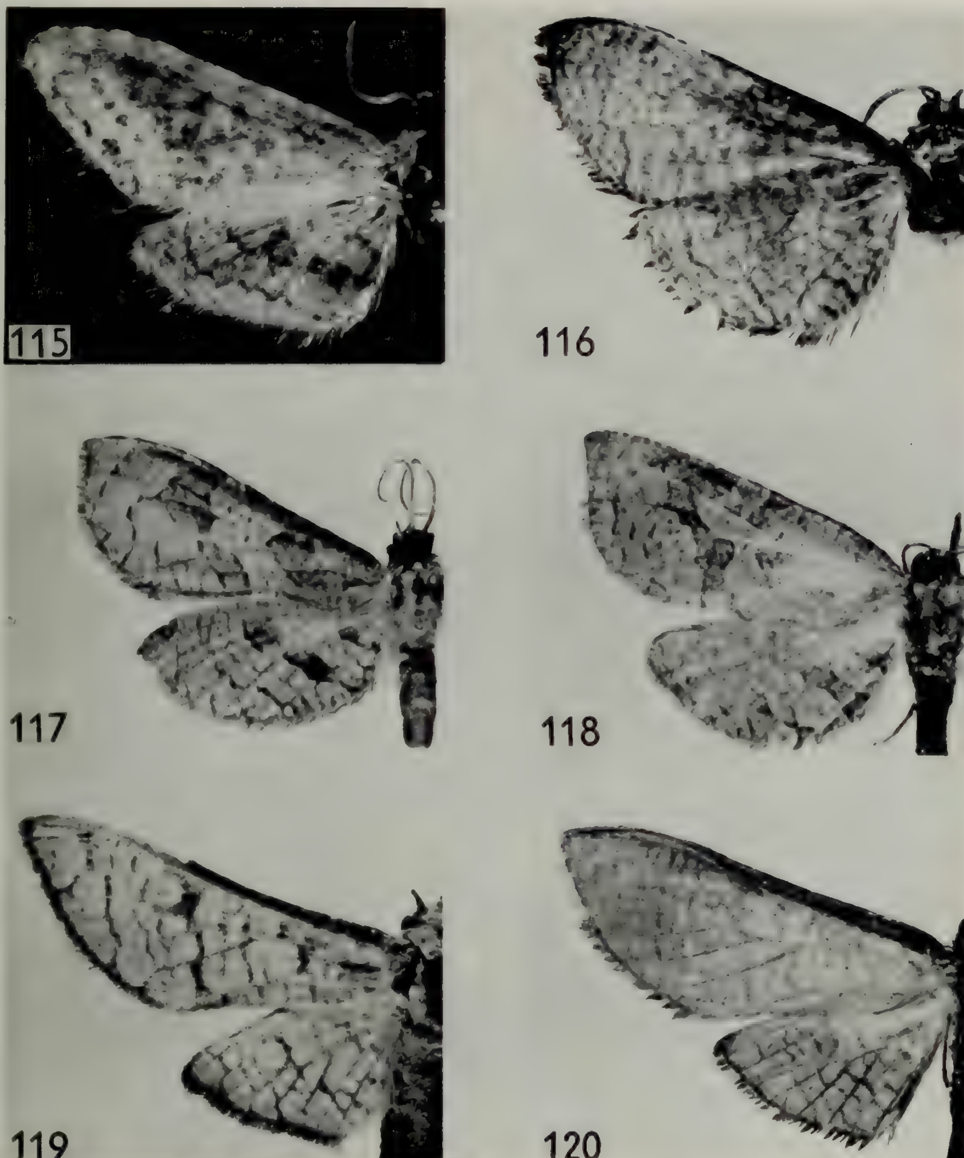
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PLATE 23

FIG. 121. *Neochrysotypus mysticus* sp. n.

FIG. 122. *Cecidothyris chrysotherma* (Hampson).

FIG. 123. *Kuja majuscula* (Gaede).

FIG. 124. *Dysodia binoculata* Warren (antero-lateral view of head). (Photo D. J. Carter.)

FIG. 125. *Cecidothyris pexa* (Hampson). (Photo D. J. Carter.) (Stereoscan view of larval skin × 1,400.)

FIG. 126. *Cecidothyris pexa* (Hampson). (Larval gall on *Terminalia* sp.)

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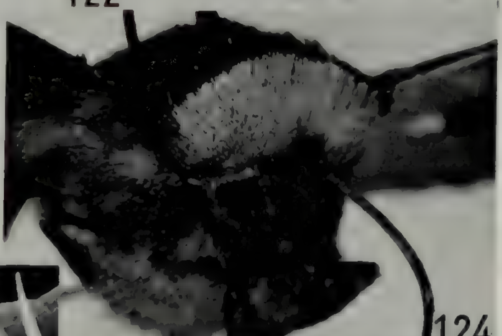

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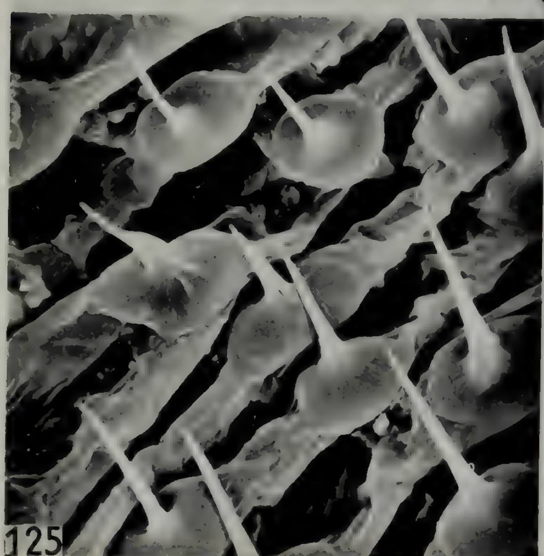

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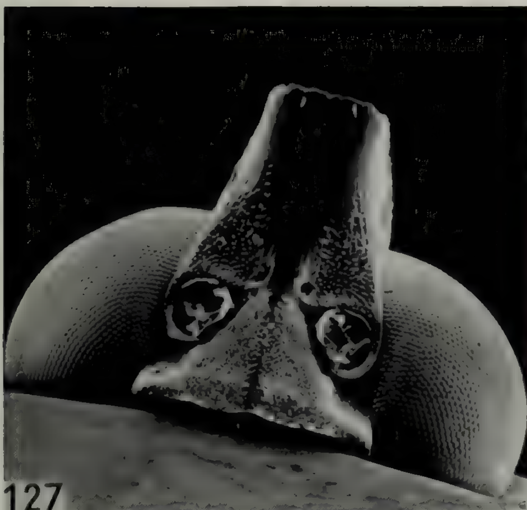
PLATE 24

FIG. 127. *Neobanisia fuliginea* sp. n. (stereoscan dorsal view of head × 38). (Photo K. Sattler.)
FIG. 128. *Neobanisia fuliginea* sp. n. (stereoscan lateral view of head × 38). (Photo K. Sattler.)
FIG. 129. *Neobanisia fuliginea* sp. n. (stereoscan anterior view of head × 70). (Photo K. Sattler.)
FIG. 130. *Striglina humeralis* sp. n. (stereoscan lateral view of eye × 34). (Photo D. J. Carter.)



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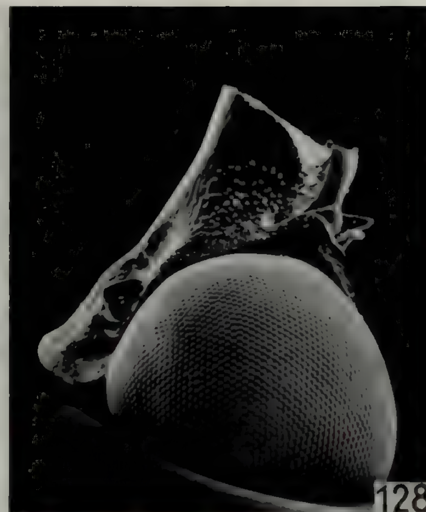

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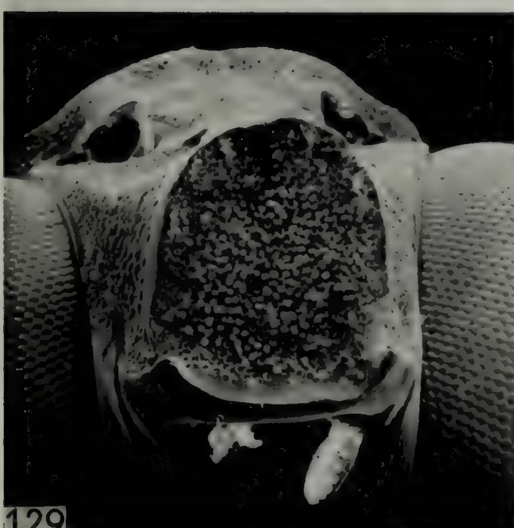

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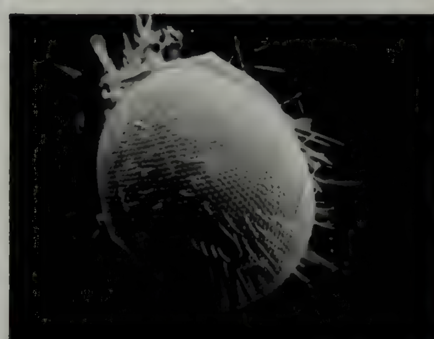

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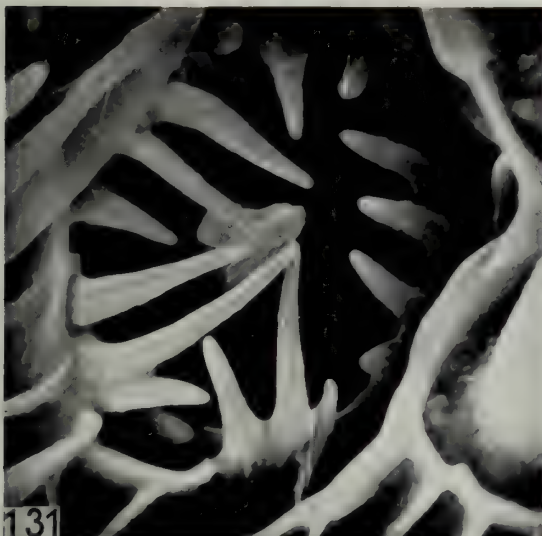
PLATE 25

FIG. 131. *Rhodoneura* (*Isothauma*) *serraticornis* Warren. (Photo D. J. Carter.) (Stereoscan of antennal segment $\times$ 4,540.)

FIG. 132. *Rhodoneura* (*Isothauma*) *serraticornis* Warren. (Photo D. J. Carter.) (Stereoscan of antennal segment $\times$ 1,860.)

FIG. 133. *Rhodoneura* (*Isothauma*) *serraticornis* Warren. (Photo D. J. Carter.) (Stereoscan of antennal segment $\times$ 940.)

FIG. 134. *Striglina guttistigma* Hampson. (Photo D. J. Carter.) (Stereoscan of tarsal segment $\times$ 186.)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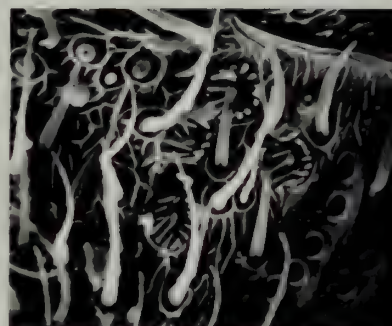
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PLATE 26

FIG. 135. *Chrystoypus dawsoni* Distant.
FIG. 136. *Chrysotypus quadratus* sp. n.
FIG. 137. *Chrystotypus tessellatus* (Warren).
FIG. 138. *Chrysotypus circumfuscus* sp. n.
FIG. 139. *Chrysotypus reticulatus* sp. n.
FIG. 140. *Chrysotypus subflavus* sp. n.

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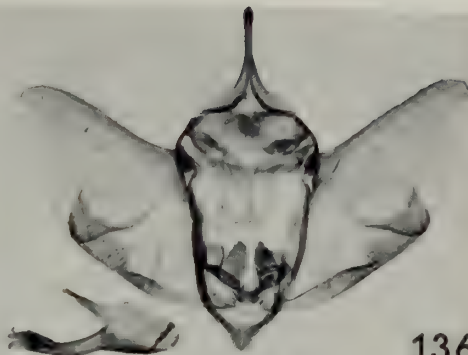

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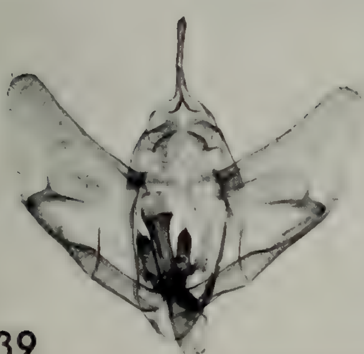

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PLATE 27

FIG. 141. *Chrysotypus luteofuscus* sp. n.
FIG. 142. *Chrysotypus splendidus* (Warren).
FIG. 143. *Neochrysotypus cerussus* sp. n.
FIG. 144. *Chrysotypus vittiferalis* Gaede.
FIG. 145. *Neochrysotypus mysticus* sp. n.
FIG. 146. *Dysodia parvita* sp. n.

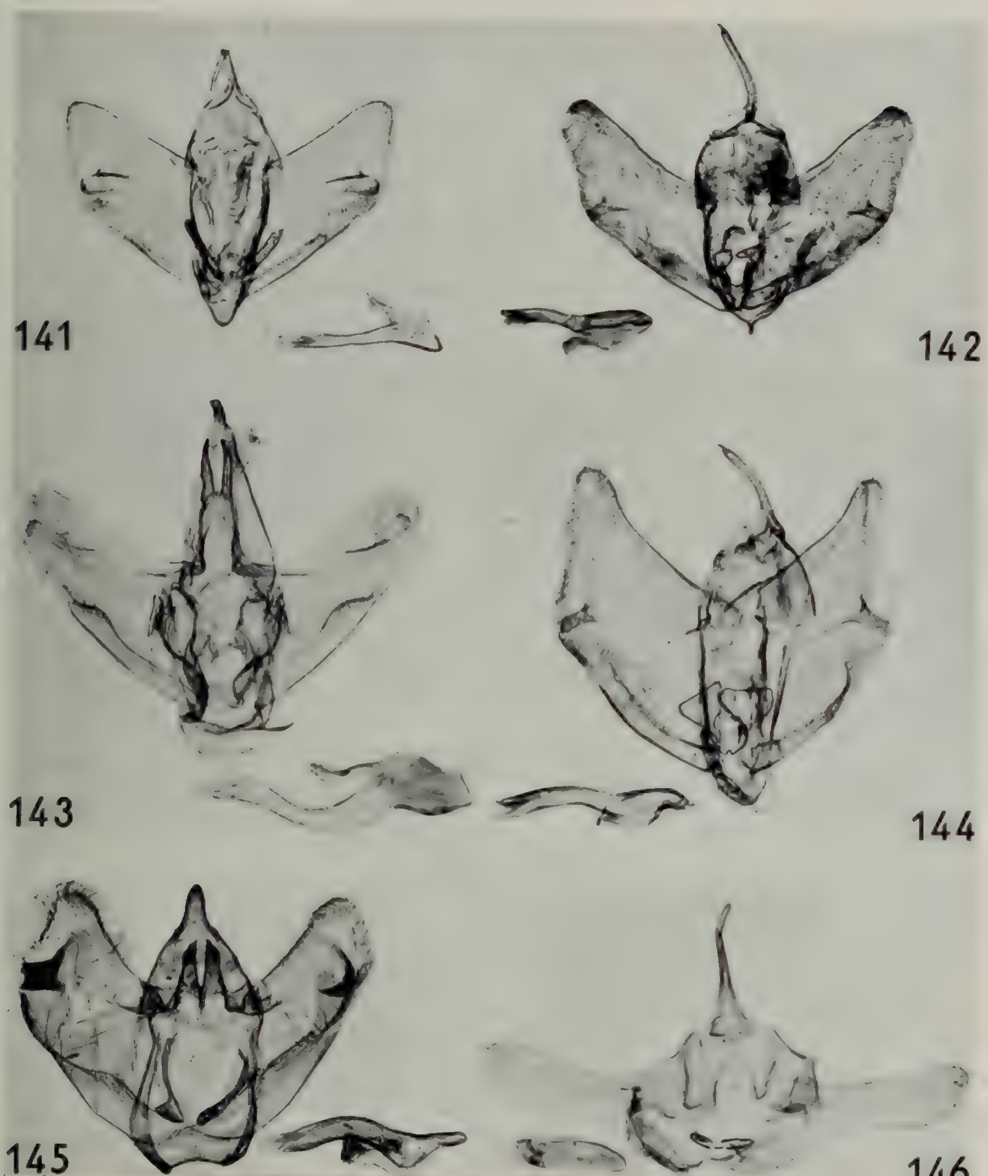
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PLATE 28

FIG. 147. *Mathoris magica* Gaede (Photo P. Whalley.)
FIG. 148. *Neobanisia joccatia* sp. n.
FIG. 149. *Neobanisia clathrula* (Guenée).
FIG. 150. *Neobanisia zamia* sp. n.
FIG. 151. *Neobanisia fuliginea* sp. n. (lateral view).
FIG. 152. *Neobanisia fuliginea* sp. n.


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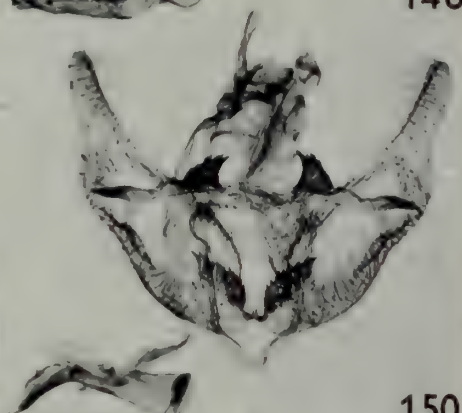
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PLATE 29

FIG. 153. *Banisia myrsusalis elaralis* (Walker).
FIG. 154. *Banisia tibiale* (Fryer).
FIG. 155. *Banisia aldabrana aldabrana* (Fryer).
FIG. 156. *Banisia apicale* (Fryer).
FIG. 157. *Banisia aldabrana cana* ssp. n.
FIG. 158. *Striglina eguttalis* Gaede.
FIG. 159. *Striglina eguttalis* Gaede (Enlargement of gnathus). (Photo P. Whalley.)

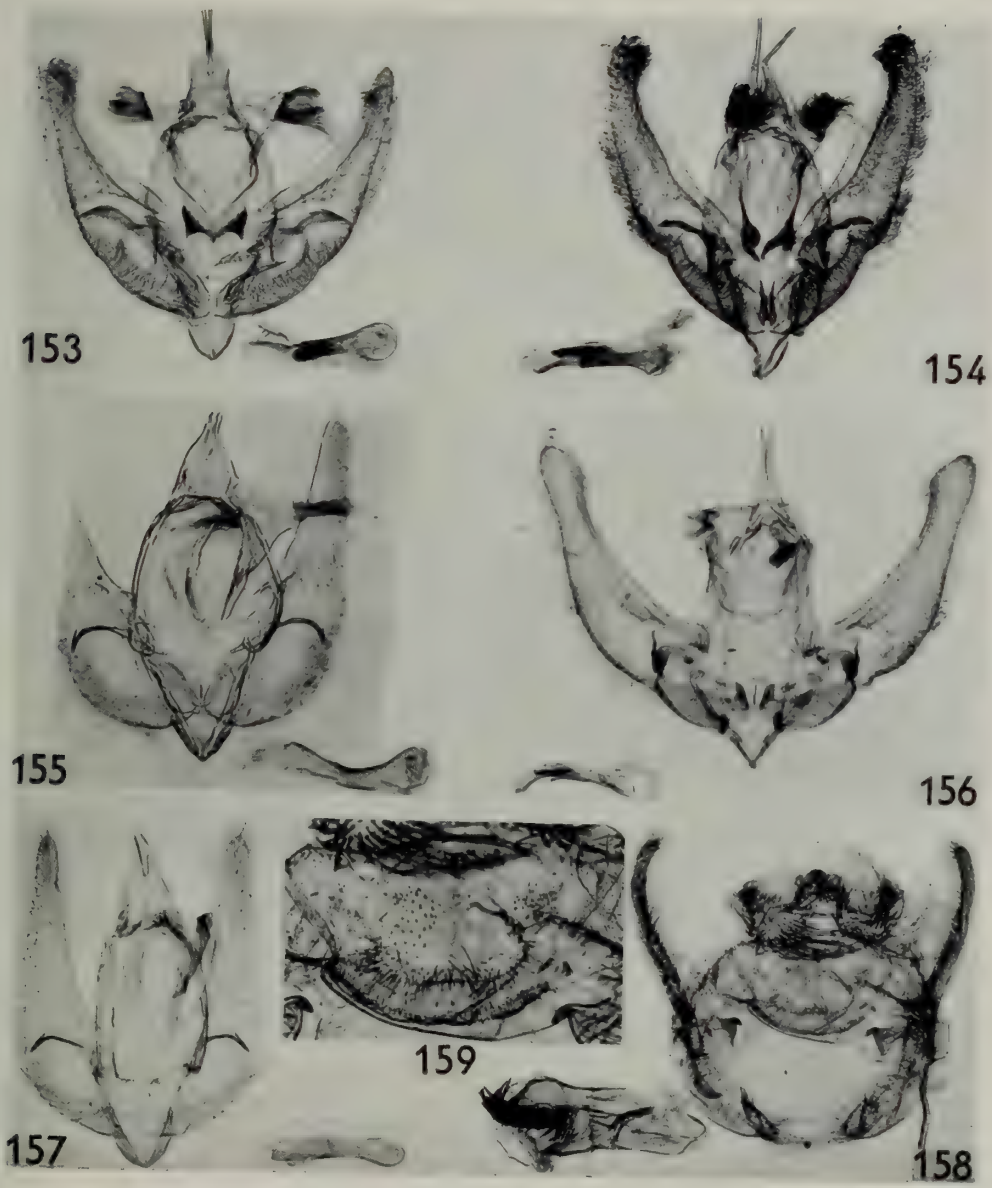
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PLATE 30

FIG. 160 *Striglina rothi* Warren.

FIG. 161. *Striglina nigranalis* (Warren).

FIG. 162. *Striglina clathrata clathrata* Hampson. (Photo P. Whalley.) (Gnathus and subscaphium.)

FIG. 163. *Striglina clathrata amani* ssp. n. (Photo P. Whalley.)

FIG. 164. *Striglina clathrata declivita* ssp. n.

FIG. 165. *Striglina clathrata clathrata* Hampson.


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PLATE 31

FIG. 166. *Striglina strigifera* Strand.
FIG. 167. *Striglina ferula* sp. n.
FIG. 168. *Striglina trepida* sp. n.
FIG. 169. *Striglina trepida* sp. n. (Enlargement of gnathus). (Photo P. Whalley.)
FIG. 170. *Striglina augescere* sp. n.
FIG. 171. *Striglina guttistigma* Hampson.
FIG. 172. *Striglina humeralis* sp. n.


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PLATE 32

FIG. 173. *Striglina vindicta vindicta* ssp. n.
FIG. 174. *Striglina vindicta ivoriensis* ssp. n.
FIG. 175. *Striglina vindicta congoensis* ssp. n.
FIG. 176. *Striglina ramosa* sp. n.
FIG. 177. *Striglina jacanda* sp. n.

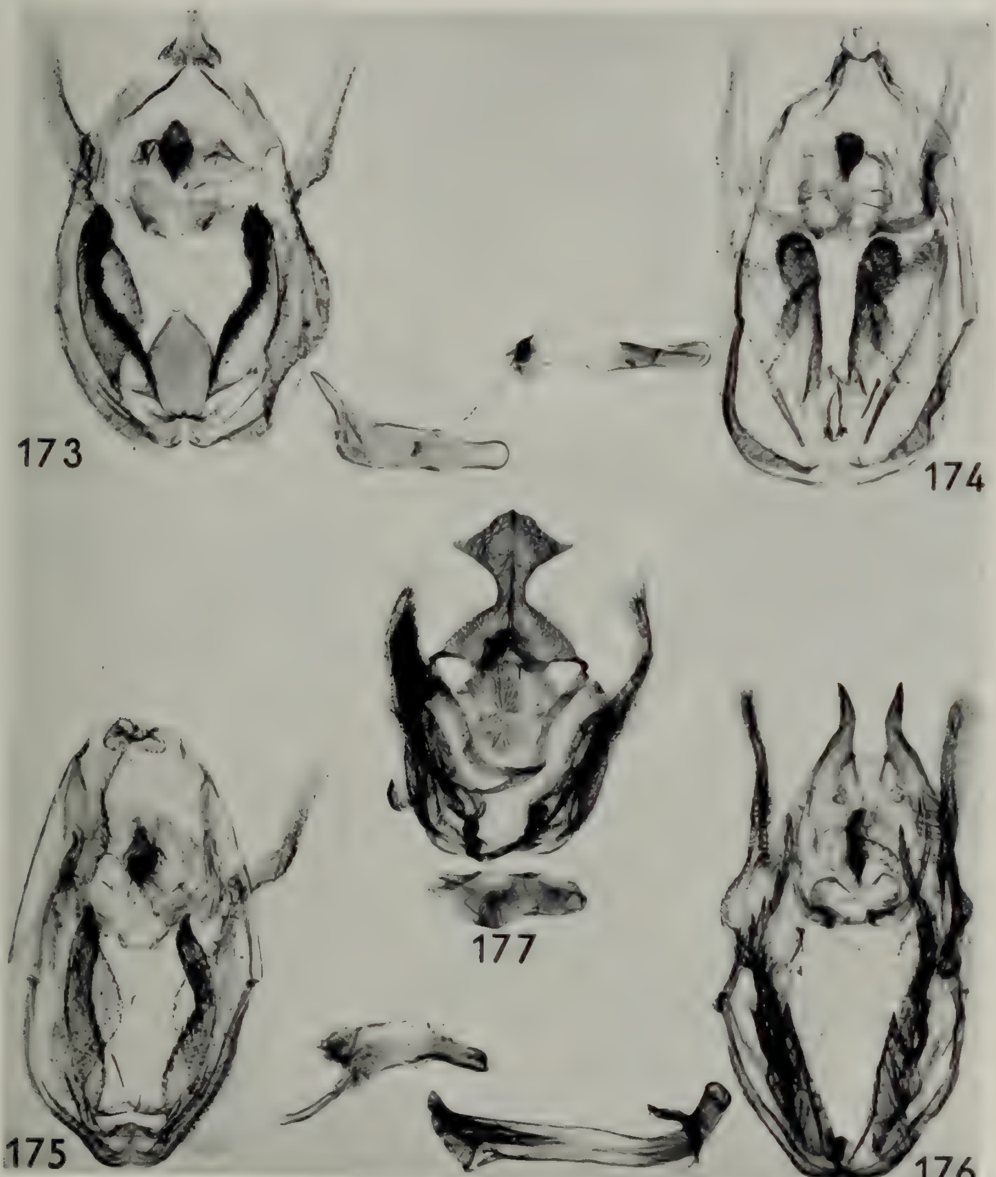
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PLATE 33

FIG. 178. *Striglina tincta* sp. n.
FIG. 179. *Rhodoneura* (*Rhodoneura*) *sordidula* (Plötz).
FIG. 180. *Rhodoneura* (*Rhodoneura*) *zurisana* sp. n.
FIG. 181. *Rhodoneura* (*Rhodoneura*) *lacunosa* sp. n.
FIG. 182. *Rhodoneura* (*Rhodoneura*) *flavicilia* Hampson.
FIG. 183. *Rhodoneura* (*Rhodoneura*) *abacha* sp. n.

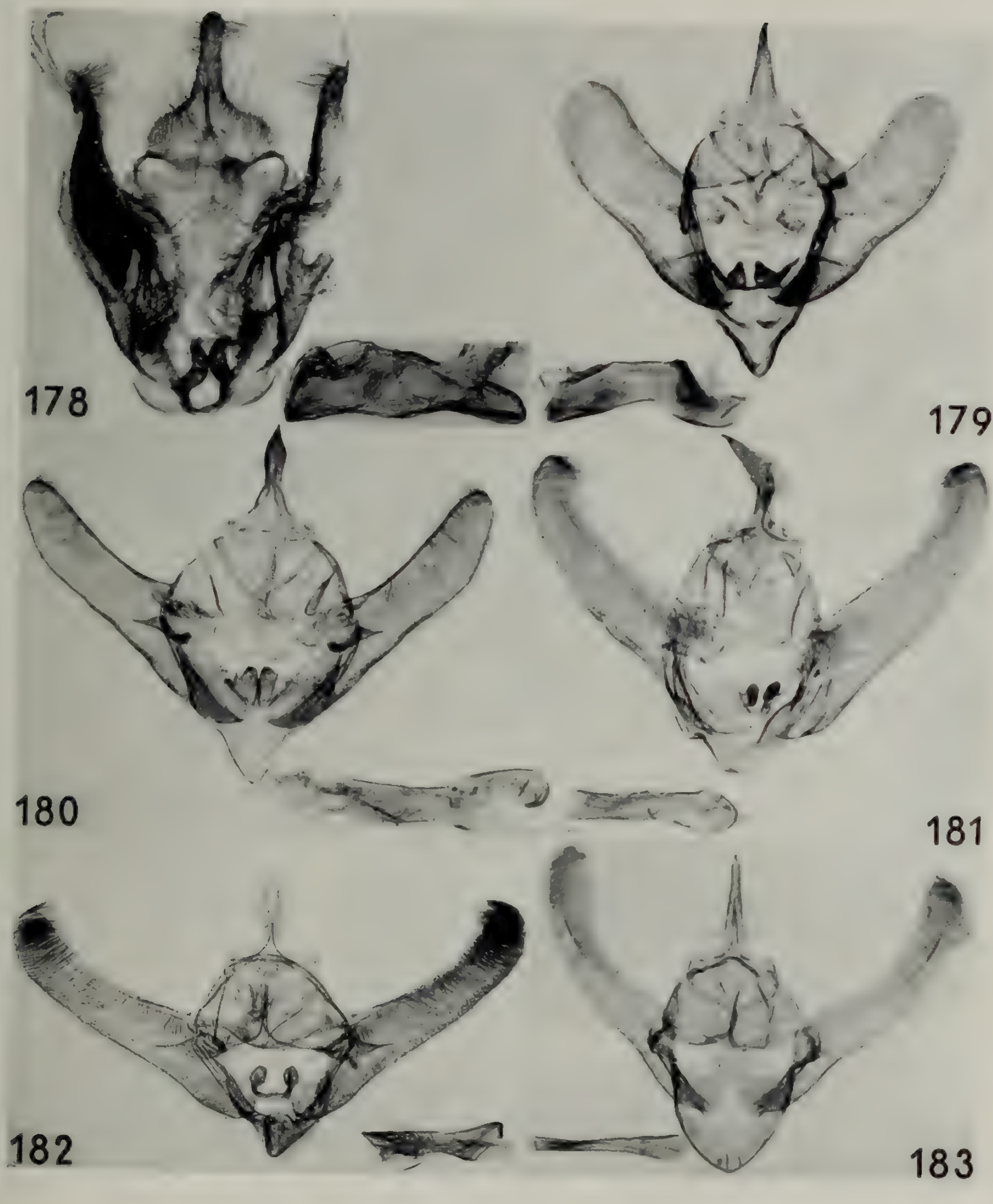
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PLATE 34

FIG. 184. *Rhodoneura* (*Rhodoneura*) *roseola* sp. n. (Photo P. Whalley.)
FIG. 185. *Rhodoneura* (*Rhodoneura*) *disjuncta* (Gaede).
FIG. 186. *Rhodoneura* (*Isothauma*) *serraticornis* (Warren).
FIG. 187. *Rhodoneura* (*Isothauma*) *serraticornis* (Warren) (Aedeagus enlarged).
FIG. 188. *Rhodoneura* (*Isothauma*) *serraticornis* (Warren) (Enlargement of juxta). (Photo P. Whalley.)
FIG. 189. *Symphleps suffusa* Warren.
FIG. 190. *Tridesmodes ramiculata* Warren.

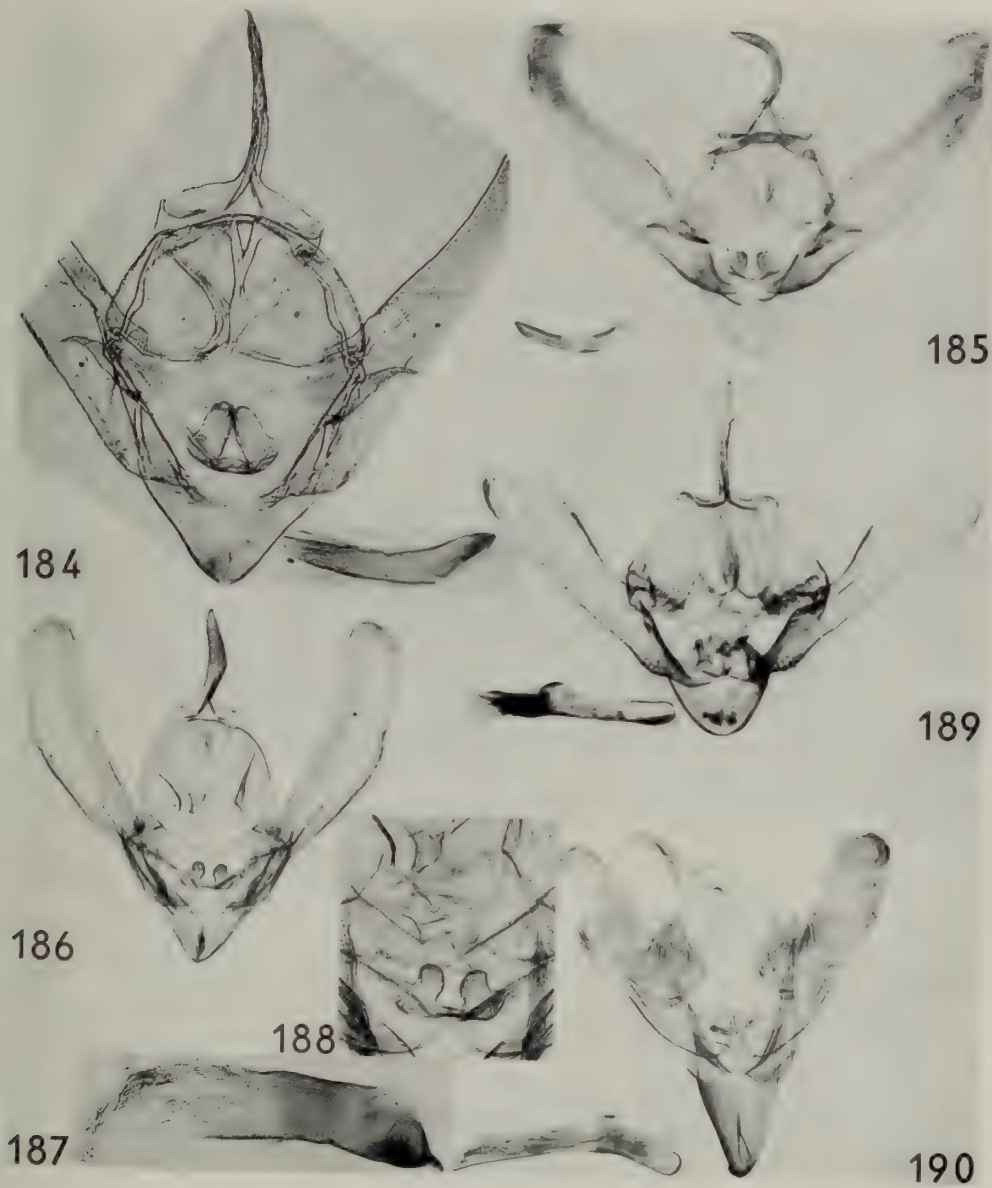

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PLATE 35

FIG. 191. *Hapana verticalis* (Warren).
FIG. 192. *Hapana carcealis* sp. n.
FIG. 193. *Hapana minima* sp. n.
FIG. 194. *Epaena inops* (Gaede).
FIG. 195. *Epaena trijuncta* (Warren).
FIG. 196. *Epaena candida* sp. n.


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PLATE 36

FIG. 197. *Epaena pellucida* sp. n.
FIG. 198. *Epaena danista* sp. n.
FIG. 199. *Epaena xystica* sp. n.
FIG. 200. *Epaena radiata* (Warren).
FIG. 201. *Epaena vocata* sp. n.
FIG. 202. *Epaena vocata* sp. n. (Enlargement of juxta). (Photo P. Whalley.)

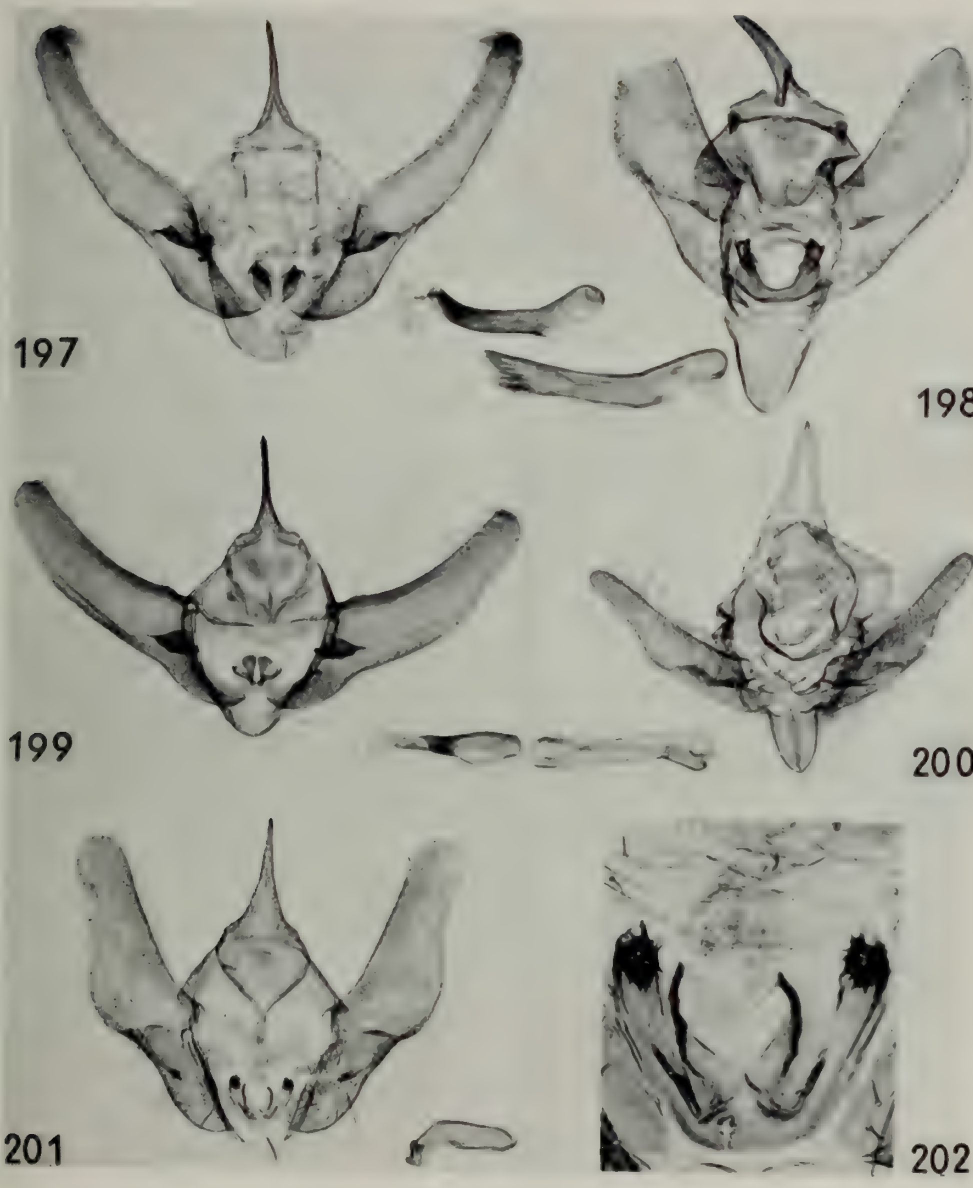
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PLATE 37

FIG. 203. *Pryalidoxa stratifica* Meyrick.
FIG. 204. *Pyralidoxa elaphropa* (Meyrick).
FIG. 205. *Kuja gemmata* (Hampson).
FIG. 206. *Kuja catenula* (Pagenstecher).
FIG. 207. *Kuja squamigera* (Pagenstecher).
FIG. 208. *Kuja obliquifascia* (Warren).

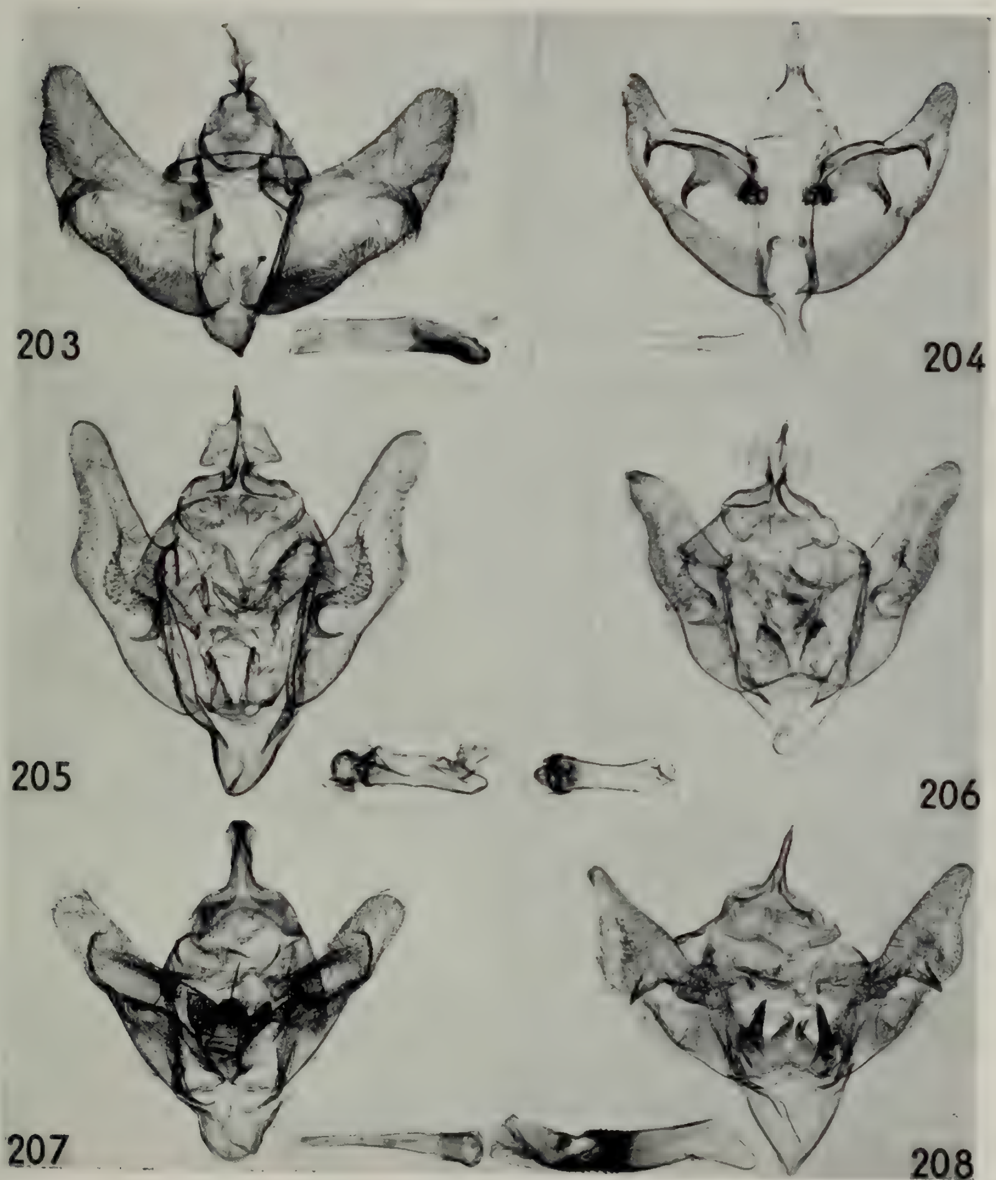
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PLATE 38

Fig. 209. *Kuja fractifascia* (Warren).
Fig. 210. *Kuja hamatipex* (Hampson).
Fig. 211. *Kuja effrenata* sp. n.
Fig. 212. *Kuja kibala* sp. n.
Fig. 213. *Kuja carcassoni* sp. n.
Fig. 214. *Hypolamprus curvifluus* (Warren).

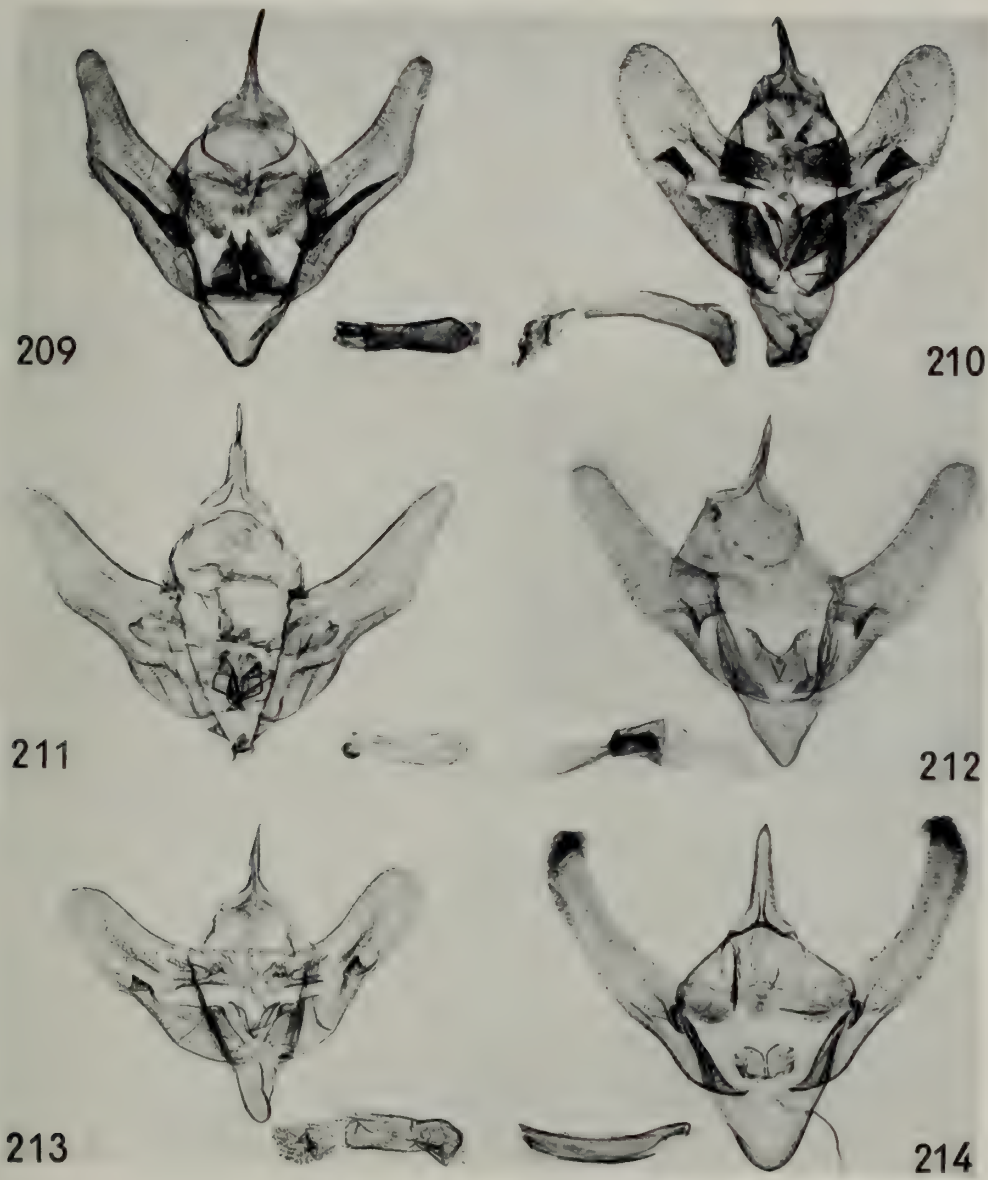
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PLATE 39

FIG. 215. *Hypolamprus distrinctus* sp. n.
FIG. 216. *Hypolamprus janenschi* (Gaede).
FIG. 217. *Hypolamprus gangaba* sp. n.
FIG. 218. *Hypolamprus gangaba* sp. n. (Enlargement of juxta). (Photo P. Whalley.)
FIG. 219. *Hypolamprus quaesitus* sp. n.
FIG. 220. *Cornuterus nigropunctulus* (Pagenstecher).

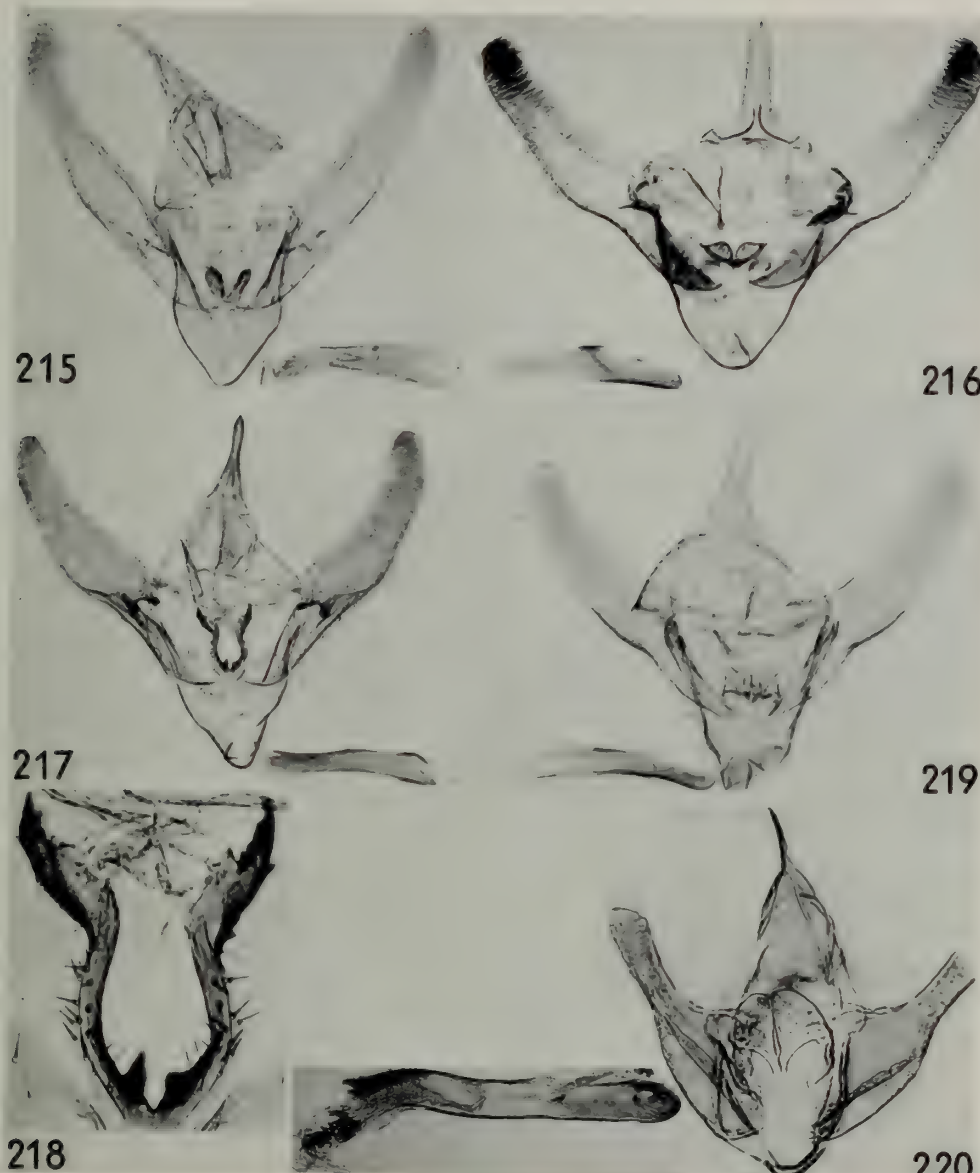
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PLATE 40

FIG. 221. *Cornuterus palairantus* (Bethune-Baker).
FIG. 222. *Bupota tranquilla tranquilla* ssp. n. (holotype). (Photo P. Whalley.)
FIG. 223. *Bupota tranquilla scripta* ssp. n.
FIG. 224. *Bupota tranquilla scripta* ssp. n. (holotype). (Photo P. Whalley.)
FIG. 225. *Bupota galbana* sp. n.
FIG. 226. *Collinsa subscripta* (Warren).
FIG. 227. *Collinsa subscripta* (Warren) (Enlargement of gnathus and juxta). (Photo P. Whalley.)

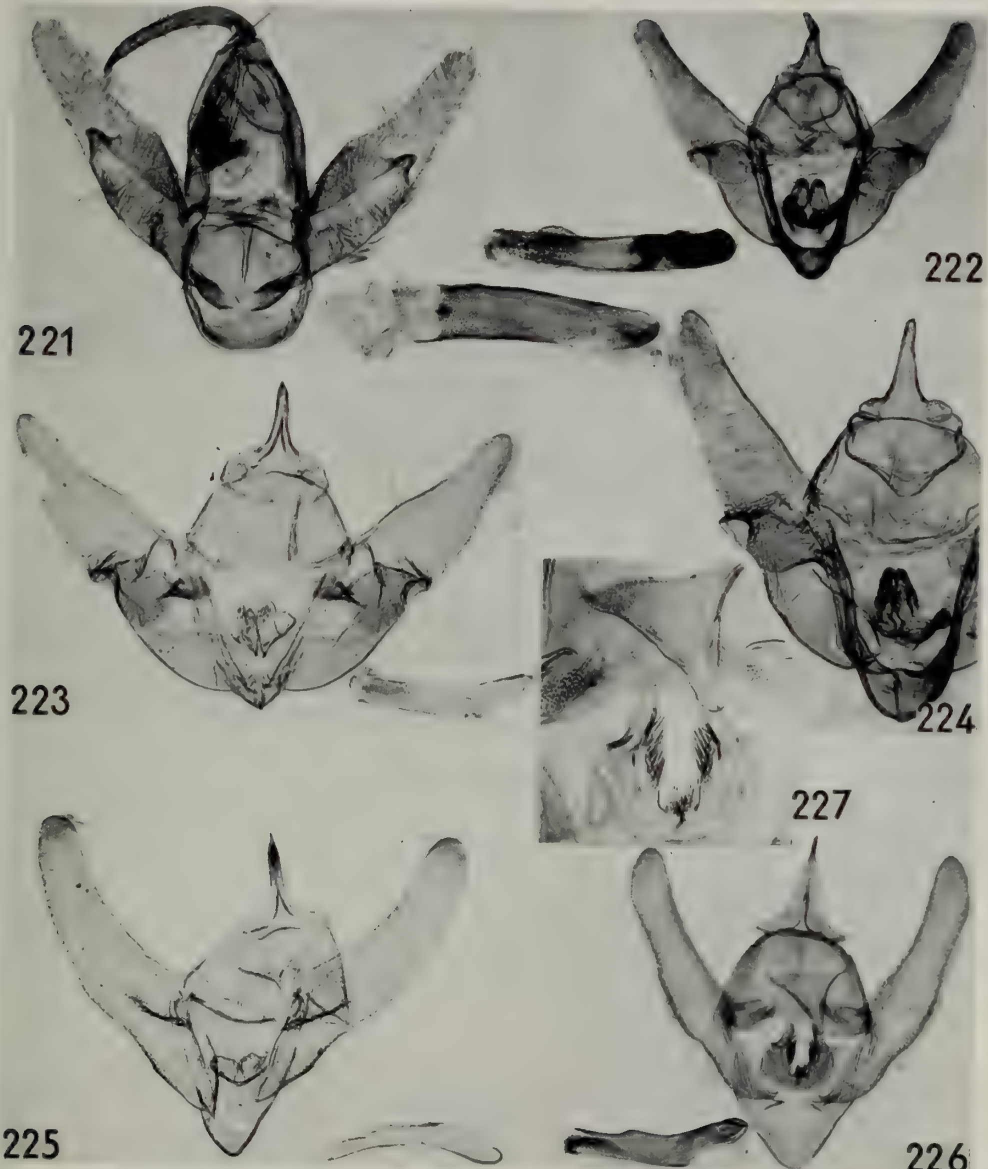
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PLATE 41

FIG. 228. *Cumbaya obstinata* sp. n.
FIG. 229. *Cumbaya unigena* sp. n.
FIG. 230. *Kalenga maculanota* sp. n.
FIG. 231. *Kalenga culanota* sp. n.
FIG. 232. *Kalenga ansorgei* (Warren).
FIG. 233. *Kalenga ansorgei* (Warren) (Basal process of valve). (Photo P. Whalley.)

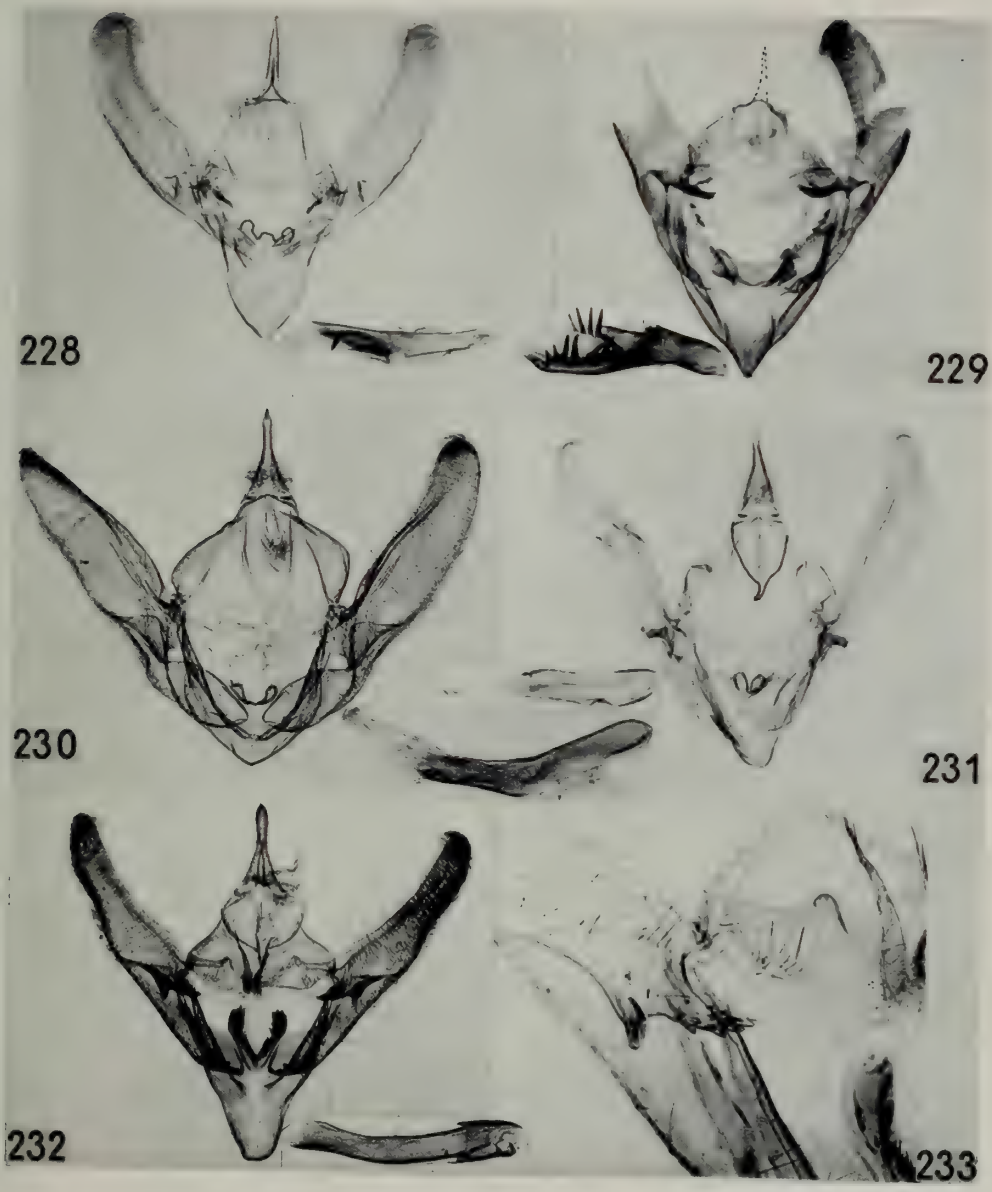
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PLATE 42

FIG. 234. *Nakawa fuscibasis* (Hampson).

FIG. 235. *Nemea tamsi* sp. n.

FIG. 236. *Nemea eugrapha* (Hampson).

FIG. 237. *Nemea eugrapha* (Hampson) (Enlargement of juxta). (Photo P. Whalley.)

FIG. 238. *Nemea eugrapha* (Hampson) (Aedeagus enlarged). (Photo P. Whalley.)

FIG. 239. *Nemea nivosa* sp. n.

FIG. 240. *Nemea nivosa* sp. n. (Enlargement to show spiny gnathus and basal processes on valves). (Photo P. Whalley.)

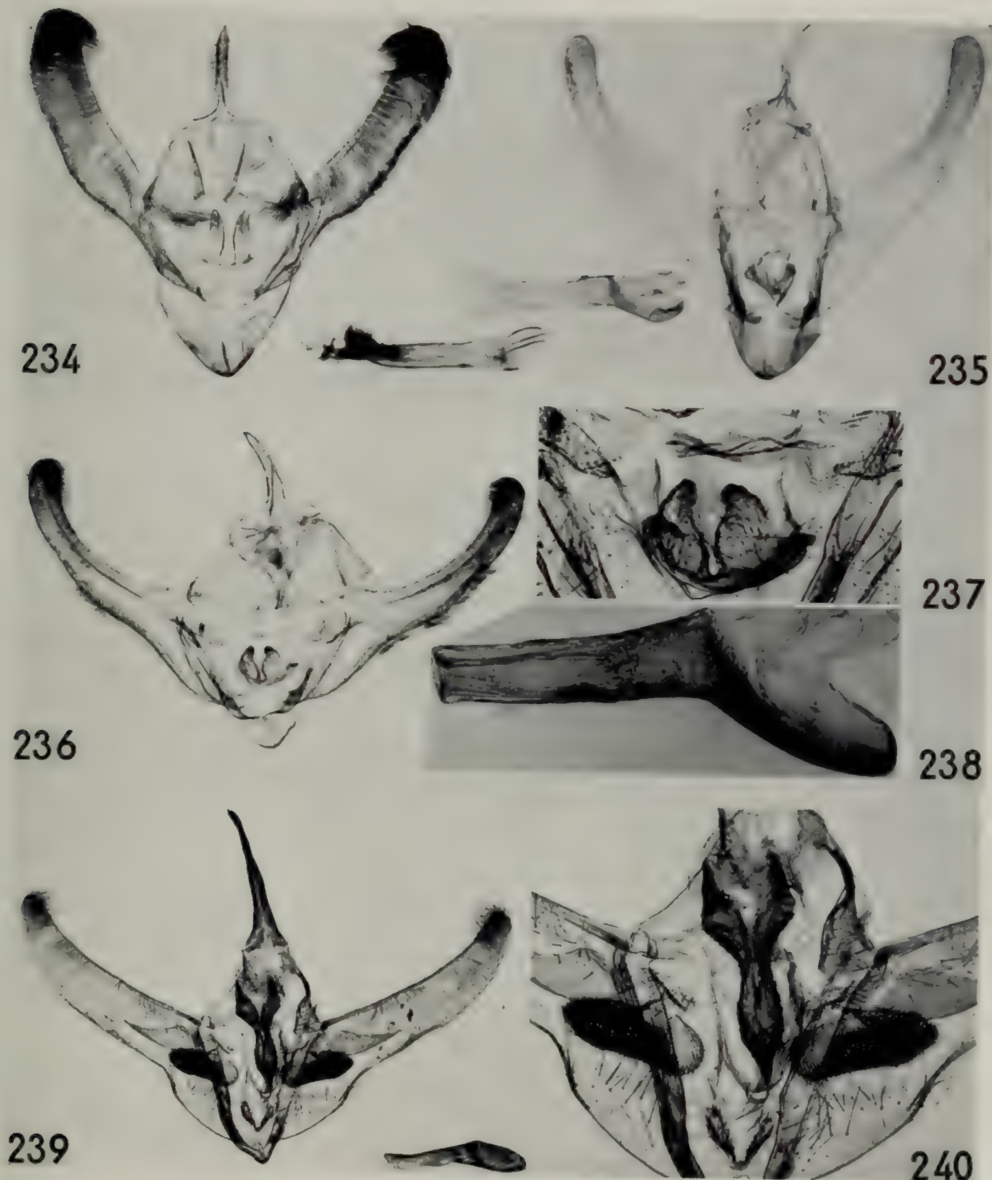
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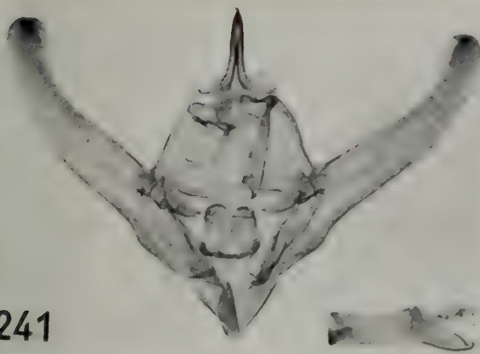
PLATE 43

FIG. 241. *Nemea ankole* sp. n.
FIG. 242. *Nemea bctousalis* (Gaede).
FIG. 243. *Sijua jejunalis* (Gaede).
FIG. 244. *Sijua sigillata* (Warren).
FIG. 245. *Sijua plagalis* (Gaede).
FIG. 246. *Sijua flavula* (Pagenstecher).



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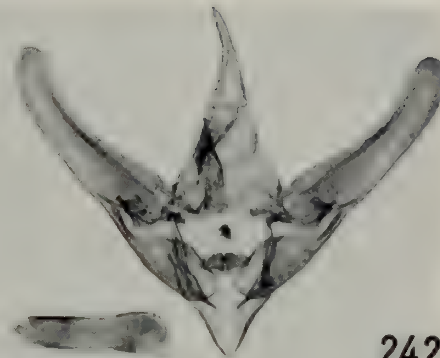

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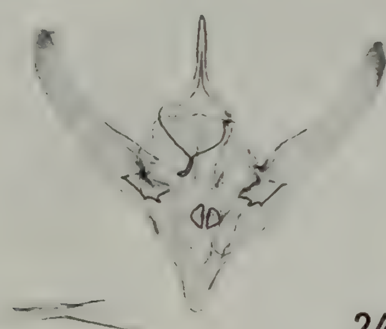

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PLATE 44

FIG. 247. *Sijua furcatula* (Pagenstecher).
FIG. 248. *Sijua parvula* sp. n.
FIG. 249. *Sijua neolatizona* sp. n.
FIG. 250. *Sijua latizonalis* (Hampson).
FIG. 251. *Sijua canitia* sp. n.
FIG. 252. *Opula spilotata* (Warren).


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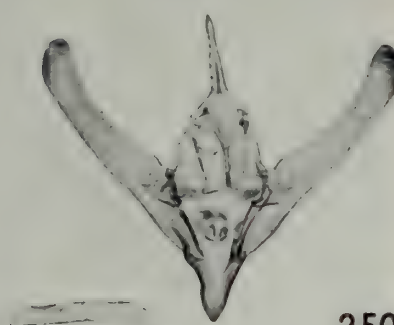
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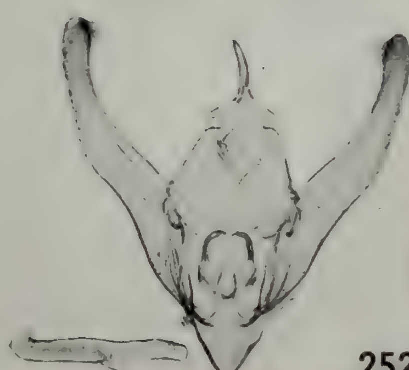
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PLATE 45

FIG. 253. *Opula impletalis* Walker.
FIG. 254. *Opula perigrapha* (Hampson).
FIG. 255. *Opula perigrapha* (Hampson) (Enlargement of juxta). (Photo P. Whalley.)
FIG. 256. *Opula scardialis* (Rebel).
FIG. 257. *Opula hebes* sp. n.
FIG. 258. *Opula monsterosa* sp. n.
FIG. 259. *Lelymena misalis* Karsch.

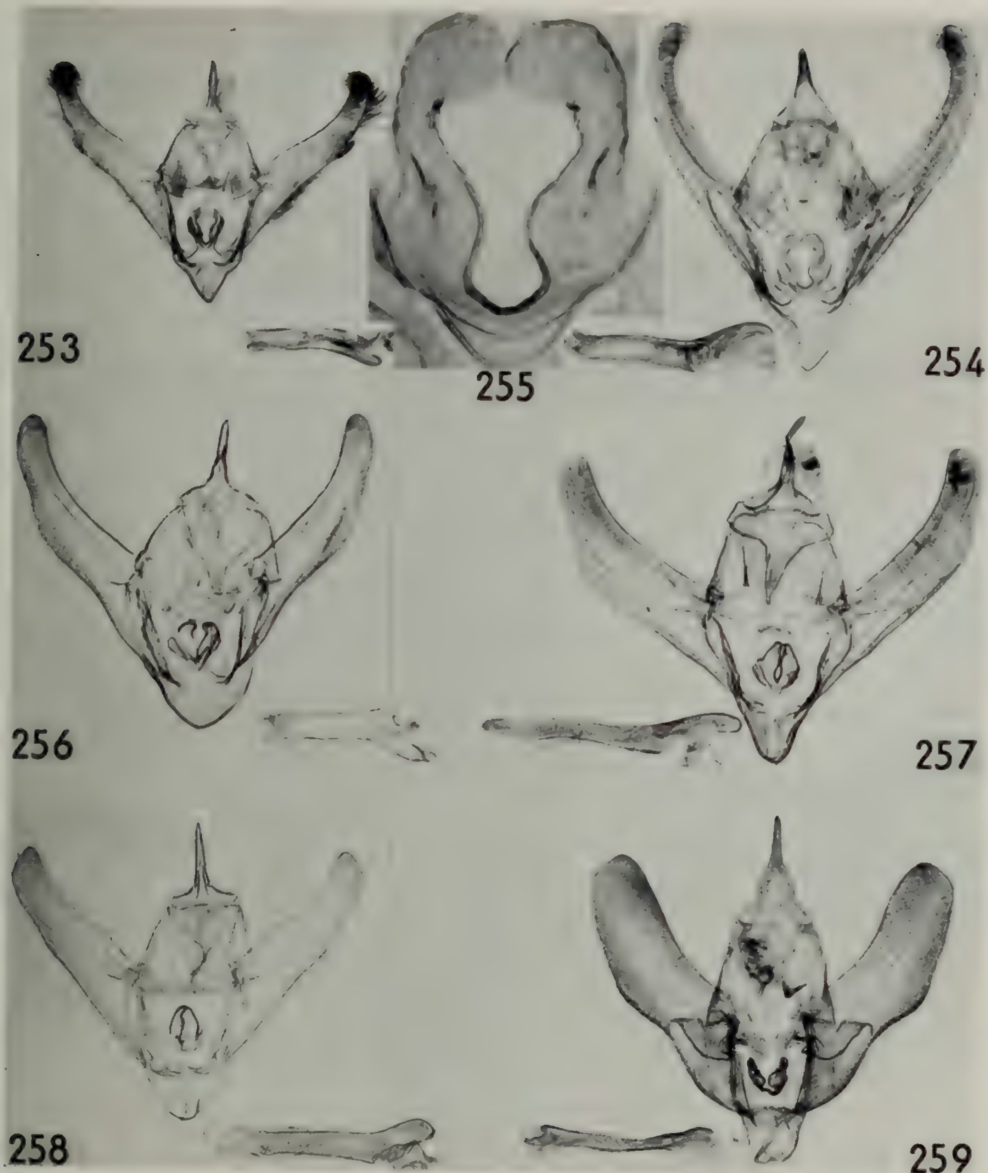
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PLATE 46

FIG. 260. *Gnathodes helvella* sp. n.
FIG. 261. *Gnathodes fiscinella* sp. n.
FIG. 262. *Sinecalca insolita* sp. n.
FIG. 263. *Sinecalca confusa* sp. n.
FIG. 264. *Cecidothyris pexa pexa* (Hampson).
FIG. 265. *Cecidothyris pexa guttulata* Aurivillius (Enlargement of juxta). (Photo P. Whalley.)

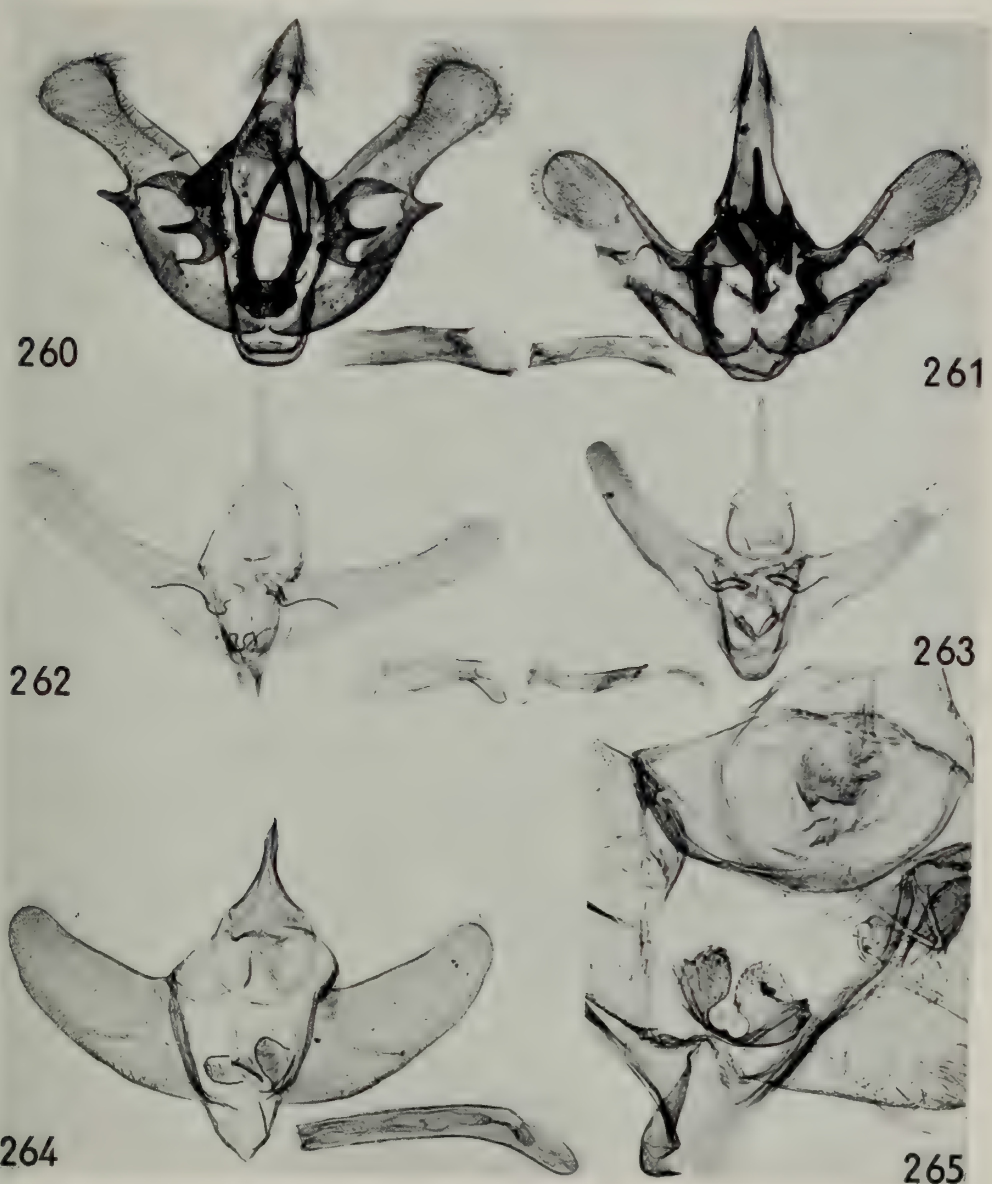
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PLATE 47

FIG. 266. *Cecidothyris chrysotherma* (Hampson).
FIG. 267. *Cecidothyris orbiferalis* (Gaede).
FIG. 268. *Cecidothyris parobifera* sp. n.
FIG. 269. *Cecidothyris tyrannica tyrannica* ssp. n.
FIG. 270. *Cecidothyris longicorpa* sp. n.
FIG. 271. *Cecidothyris tyrannica afinia* ssp. n.

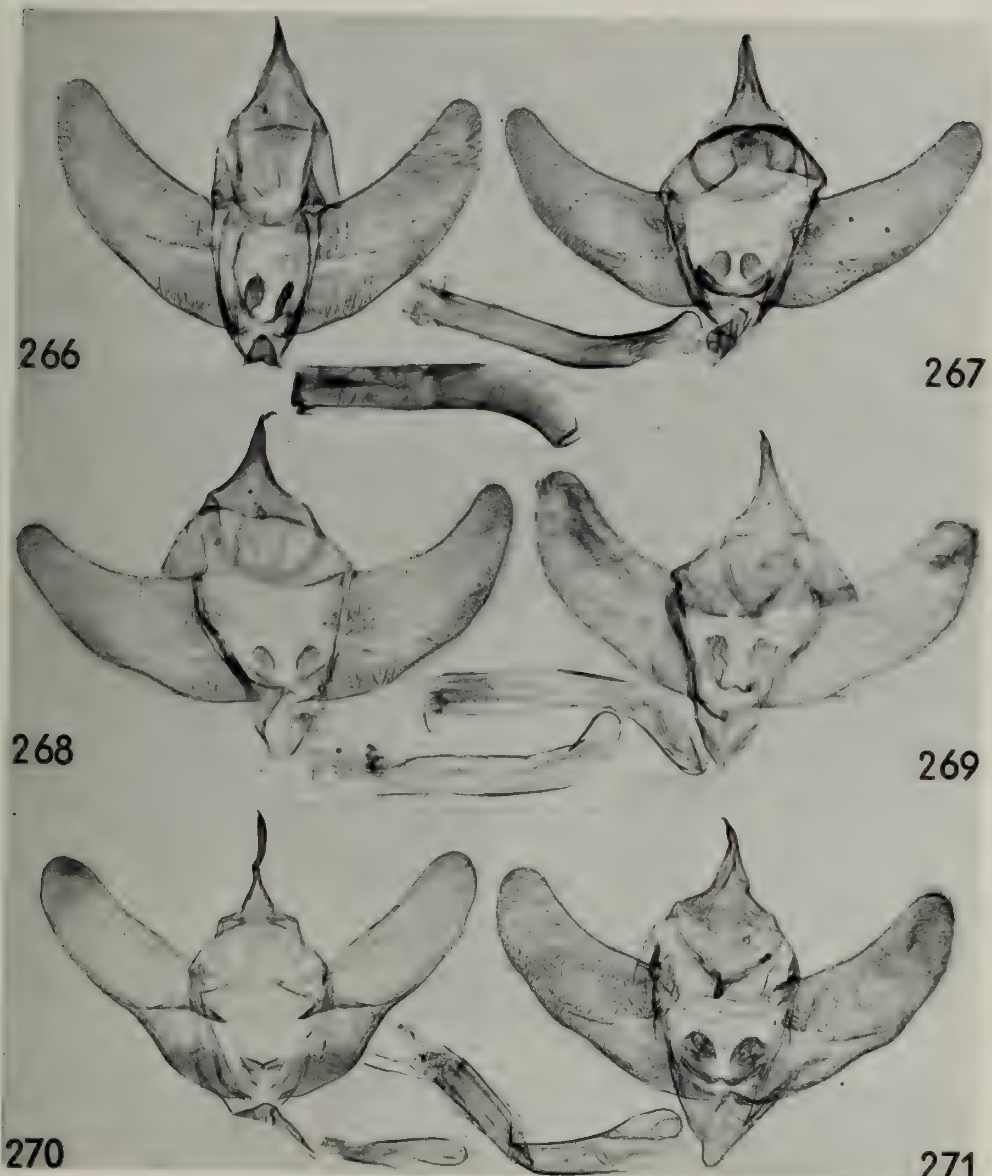
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PLATE 48

FIG. 272. *Chrysotypus dawsoni* Distant.
FIG. 273. *Chrysotypus dawsoni* Distant (Anal papillae and ostium).
FIG. 274. *Chrysotypus quadratus* sp. n.
FIG. 275. *Chrysotypus quadratus* sp. n. (Ostium).
FIG. 276. *Chrysotypus splendidus* Warren.
FIG. 277. *Chrysotypus circumfuscus* sp. n.
FIG. 278. *Chrysotypus circumfuscus* sp. n. (Anal papillae and ostium).

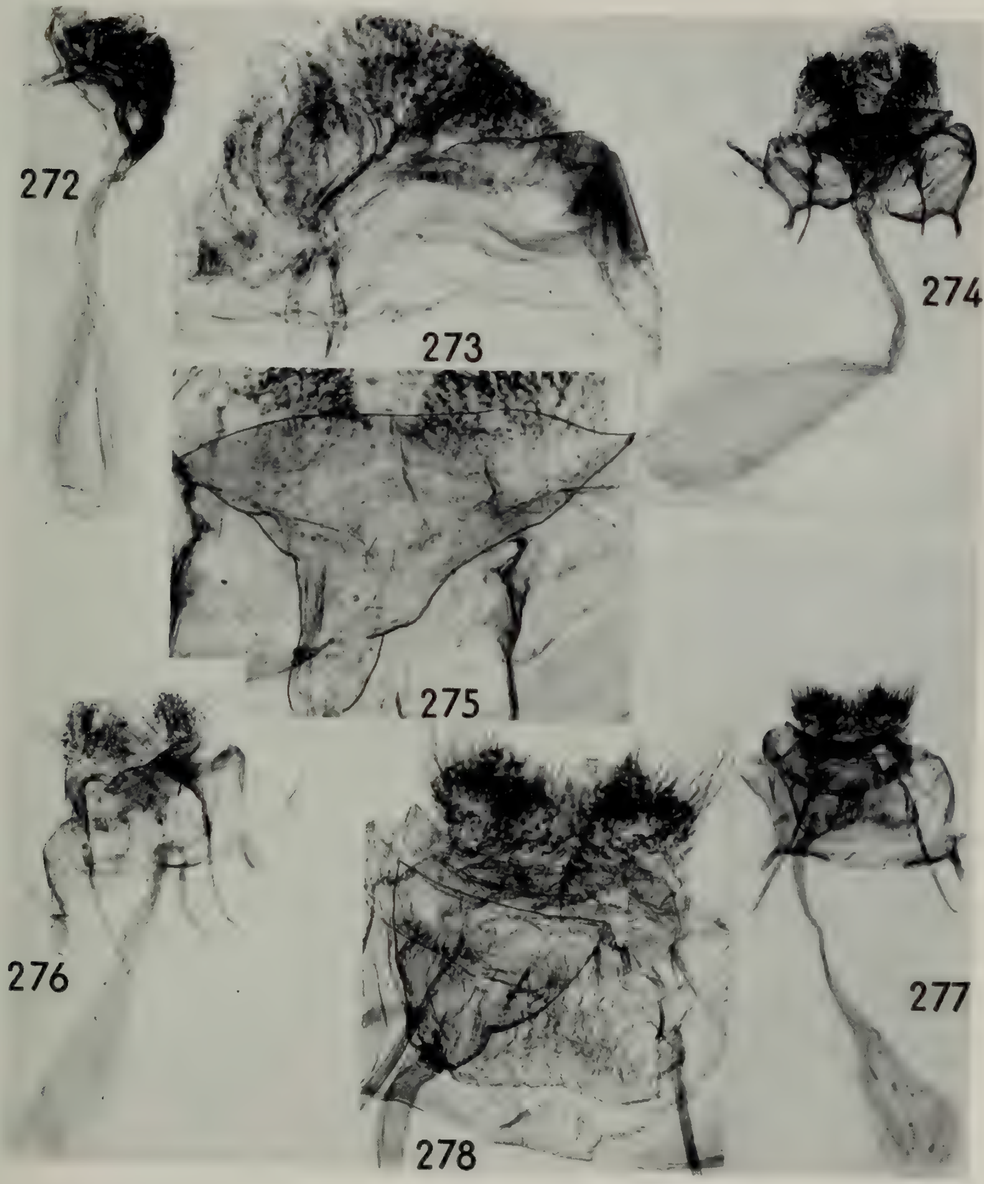
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PLATE 49

FIG. 279. *Chrysotypus tessellatus* (Warren).
FIG. 280. *Chrysotypus tessellatus* (Warren). (Ostium.)
FIG. 281. *Chrysotypus vittiferalis* (Gaede).
FIG. 282. *Chrysotypus vittiferalis* (Gaede). (Ostium.)
FIG. 283. *Chrysotypus reticulatus* sp. n.
FIG. 284. *Chrysotypus reticulatus* sp. n. (Ostium.)

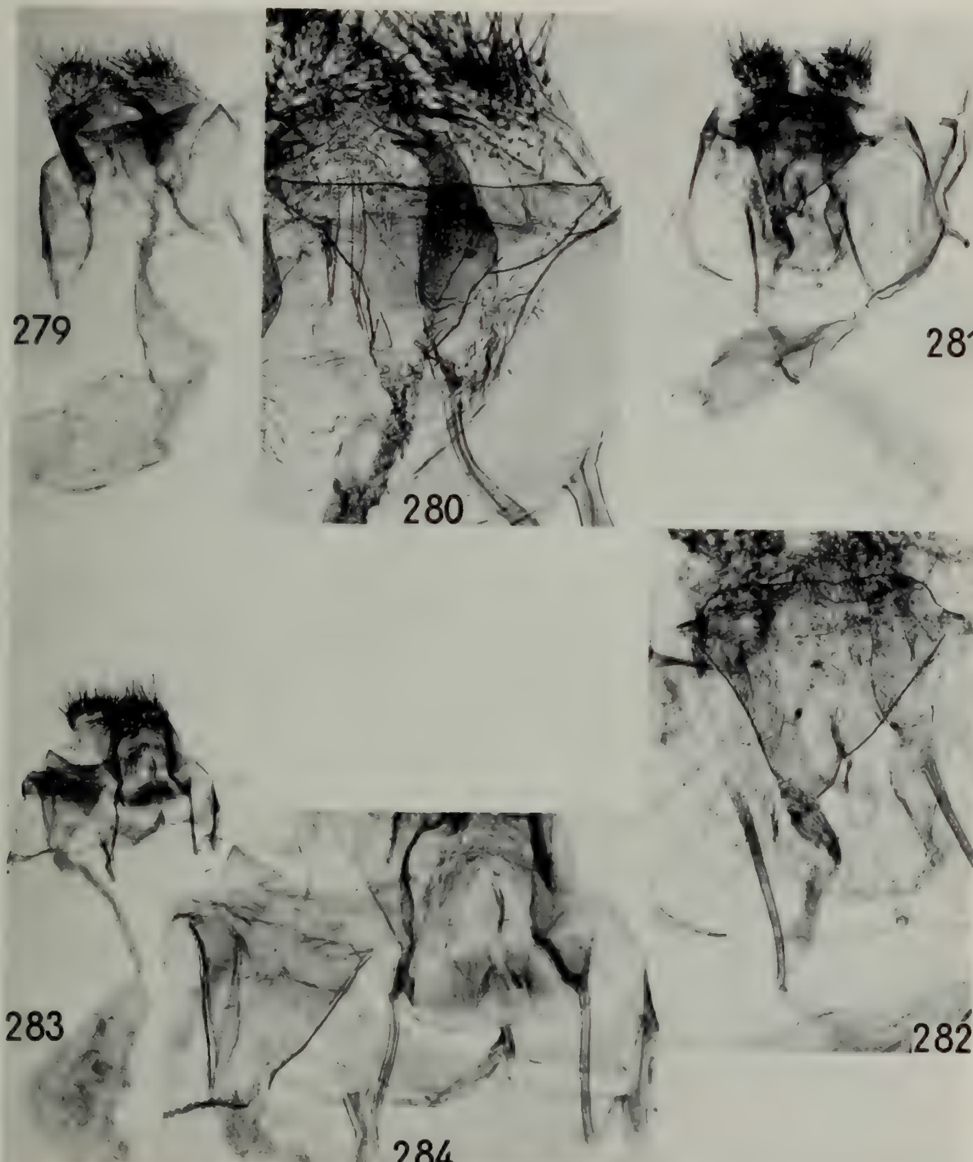
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PLATE 50

FIG. 285. *Dysodia magnifica* Whalley.
FIG. 286. *Dysodia magnifica* Whalley. (Signum.)
FIG. 287. *Mathoris magica* Gaede.
FIG. 288. *Neobanisia joccatia* sp. n.
FIG. 289. *Neobanisia joccatia* sp. n. (Ostium.) (Photo P. Whalley.)
FIG. 290. *Neobanisia fuliginea* sp. n. (Ostium.) (Photo P. Whalley.)
FIG. 291. *Neobanisia fuliginea* sp. n. (Bursa.)

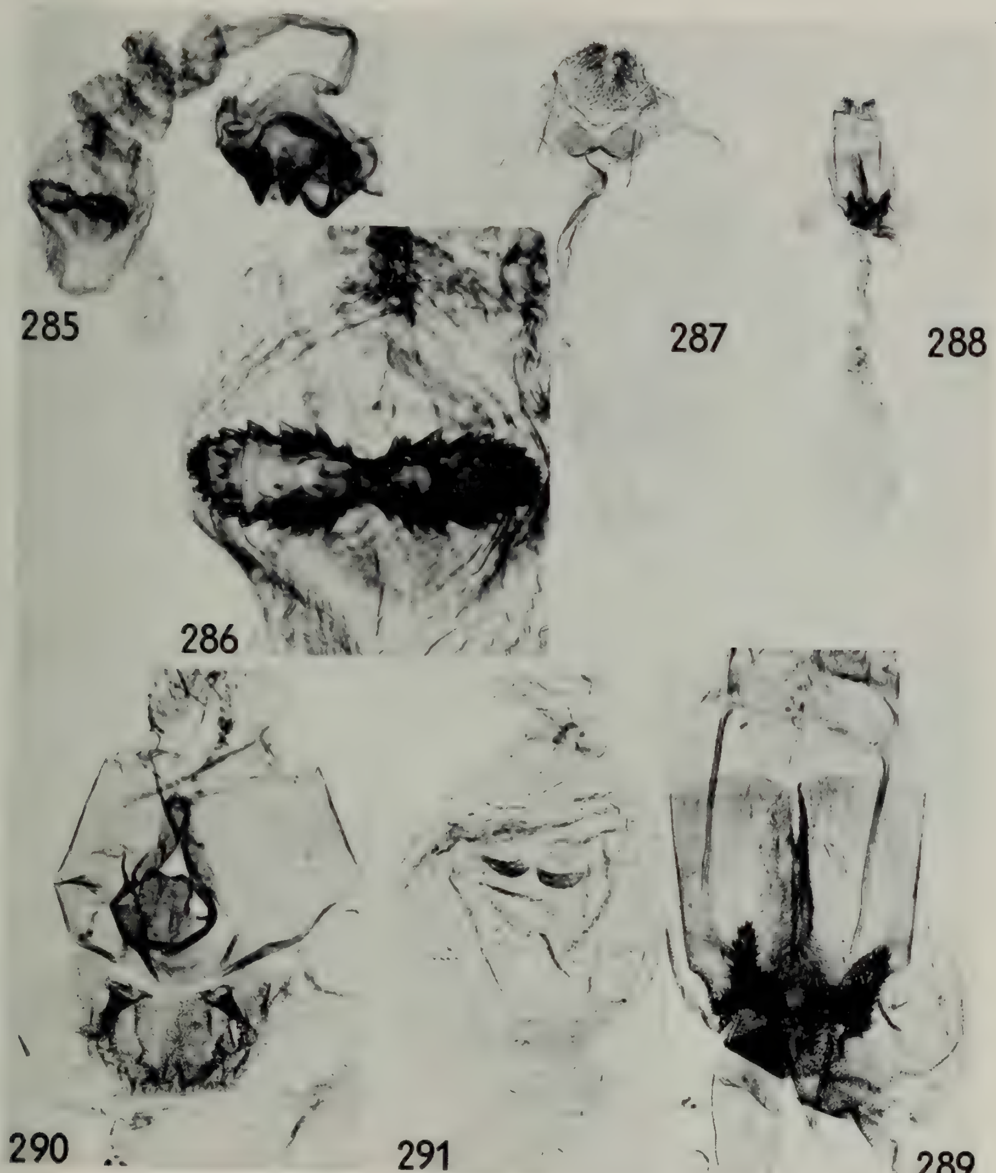
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PLATE 51

FIG. 292. *Neobanisia inoptata* sp. n. (Anal papillae and ostium.)
FIG. 293. *Neobanisia inoptata* sp. n. (Ostium.) (Photo P. Whalley.)
FIG. 294. *Neobanisia inoptata* sp. n. (Bursa.)
FIG. 295. *Neobanisia clathrula* (Guenée).
FIG. 296. *Neobanisia clathrula* (Guenée). (Bursa.)
FIG. 297. *Banisia myrsusalis elaralis* (Walker).
FIG. 298. *Banisia myrsusalis elaralis* (Walker). (Signum.)

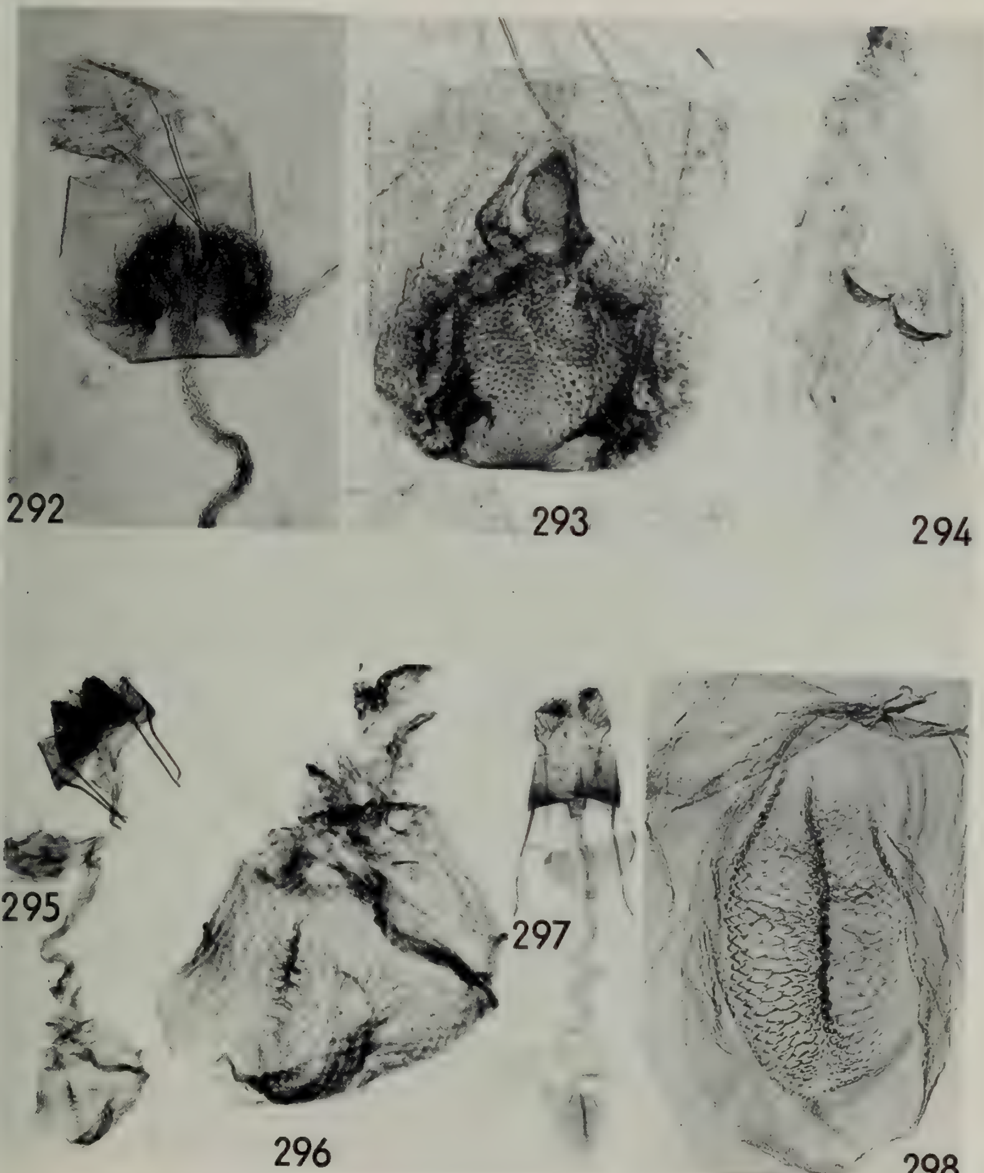
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PLATE 52

FIG. 299. *Banisia aldabrana aldabrana* (Fryer).
FIG. 300. *Banisia aldabrana aldabrana* (Fryer). (Bursa.)
FIG. 301. *Striglina rothi* Warren.
FIG. 302. *Striglina rothi* Warren. (Anal papillae and ostium.)
FIG. 303. *Striglina eguttalis* Gaede.
FIG. 304. *Striglina eguttalis* Gaede. (Anal papillae and ostium.)
FIG. 305. *Striglina eguttalis* Gaede. (Signum.)


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PLATE 53

FIG. 306. *Striglina clathrata clathrata* Hampson.
FIG. 307. *Striglina clathrata clathrata* Hampson. (Anal papillae and ostium.)
FIG. 308. *Striglina clathrata clathrata* Hampson. (Signum.)
FIG. 309. *Striglina clathrata declivita* ssp. n. (Anal papillae and ostium.) (Photo P. Whalley.)
FIG. 310. *Striglina strigifera* Strand.
FIG. 311. *Striglina strigifera* Strand. (Anal papillae and ostium.)
FIG. 312. *Striglina strigifera* Strand. (Signum.)

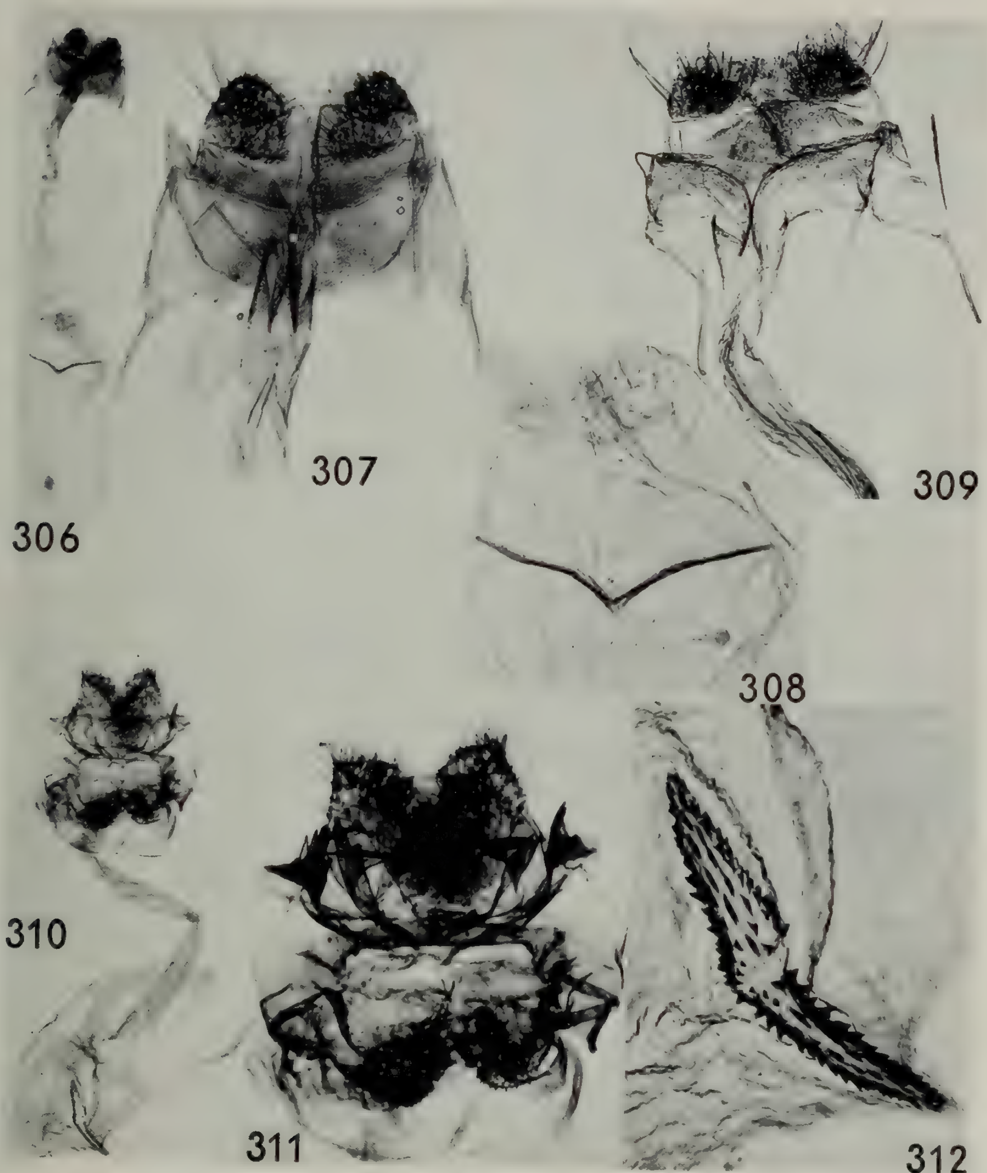

PLATE 54

FIG. 313. *Striglina ramosa* sp. n.
FIG. 314. *Striglina ramosa* sp. n. (Bursa.)
FIG. 315. *Striglina guttistigma* Hampson.
FIG. 316. *Striglina guttistigma* Hampson. (Signum.)
FIG. 317. *Striglina jacanda* sp. n.
FIG. 318. *Striglina jacanda* sp. n. (Ostium.)
FIG. 319. *Striglina jacanda* sp. n. (Signum.)
FIG. 320. *Striglina humeralis* sp. n.

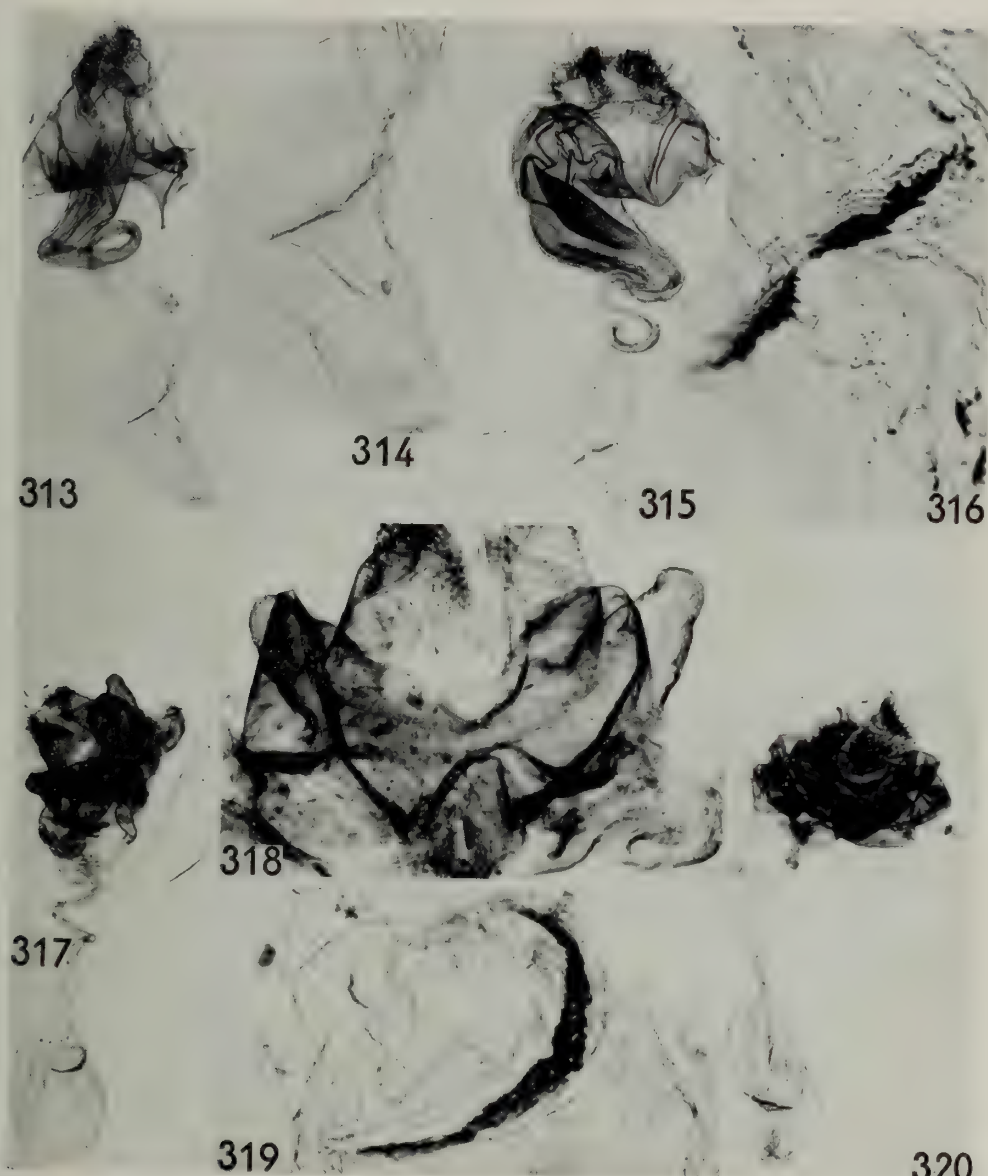
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PLATE 55

FIG. 321. *Striglina nigranalis* (Warren).
FIG. 322. *Striglina nigranalis* (Warren). (Anal papillae and ostium.)
FIG. 323. *Rhodoneura* (*Rhodoneura*) *sordidula* (Plötz).
FIG. 324. *Rhodoneura* (*Rhodoneura*) *sordidula* (Plötz). (Ostium.)
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FIG. 326. *Rhodoneura* (*Rhodoneura*) *lacunosa* sp. n.
FIG. 327. *Rhodoneura* (*Rhodoneura*) *lacunosa* sp. n. (Anal papillae and ostium.)
FIG. 328. *Rhodoneura* (*Rhodoneura*) *flavicilia* Hampson.
FIG. 329. *Rhodoneura* (*Rhodoneura*) *flavicilia* Hampson. (Ostium.)

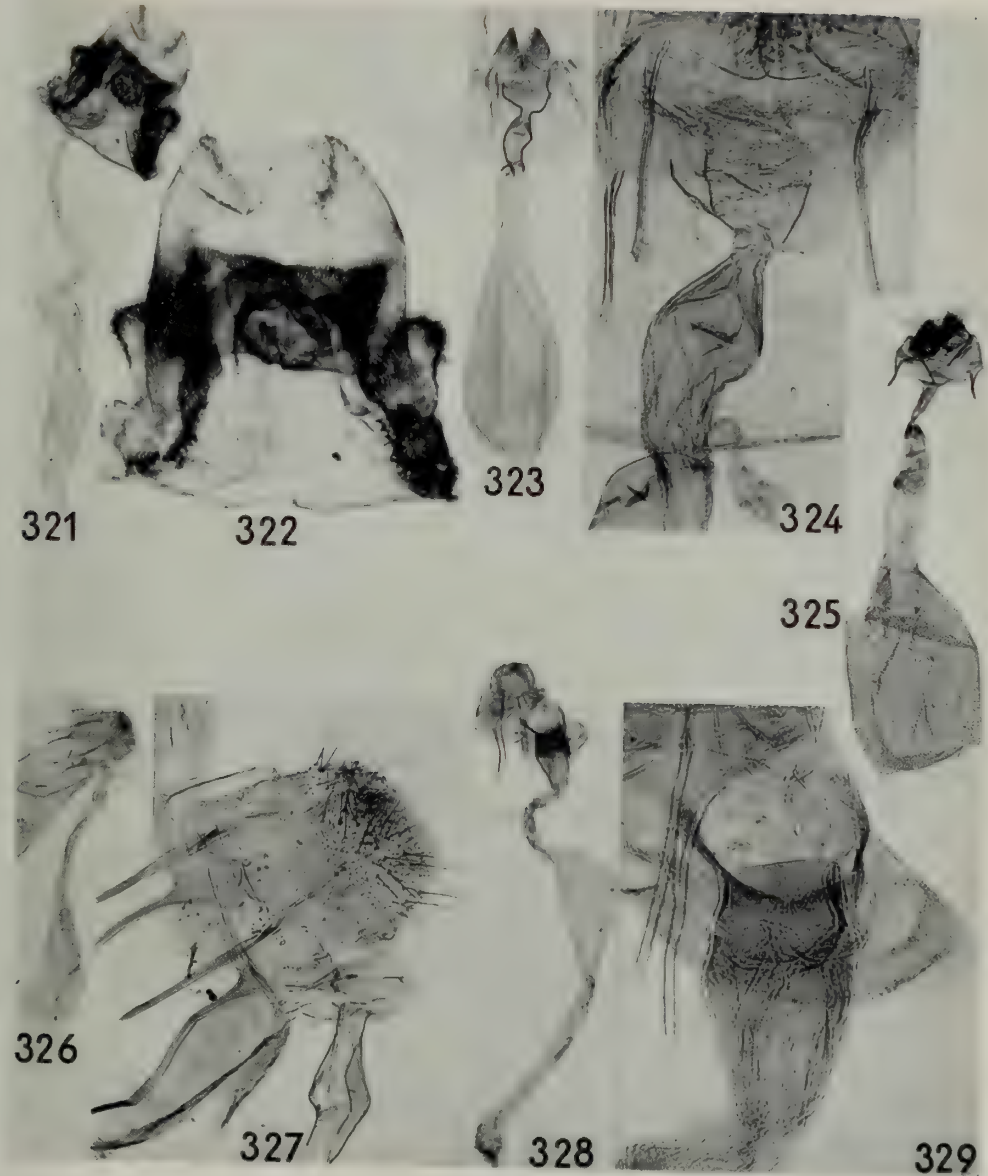
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PLATE 56

FIG. 330. *Rhodoneura* (*Rhodoneura*) *roseola* sp. n.
FIG. 331. *Rhodoneura* (*Rhodoneura*) *roseola* sp. n. (Bursa.)
FIG. 332. *Rhodoneura* (*Rhodoneura*) *disjuncta* (Gaede).
FIG. 333. *Rhodoneura* (*Rhodoneura*) *disjuncta* (Gaede). (Anal papillae and ostium.) (Photo P. Whalley.)
FIG. 334. *Rhodoneura* (*Isothauma*) *serraticornis* (Warren).
FIG. 335. *Rhodoneura* (*Isothauma*) *serraticornis* (Warren). (Signum.) (Photo P. Whalley.)
FIG. 336. *Rhodoneura* (*Isothauma*) *serraticornis* (Warren). (Signum.) (Photo P. Whalley.)
FIG. 337. *Rhodoneura* (*Isothauma*) *serraticornis* (Warren). (Signum.) (Photo P. Whalley.)
FIG. 338. *Rhodoneura* (*Isothauma*) *serraticornis* (Warren). (Signum.) (Photo P. Whalley.)
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FIG. 340. *Symphleps suffusa* Warren. (Bursa.) (Photo P. Whalley.)

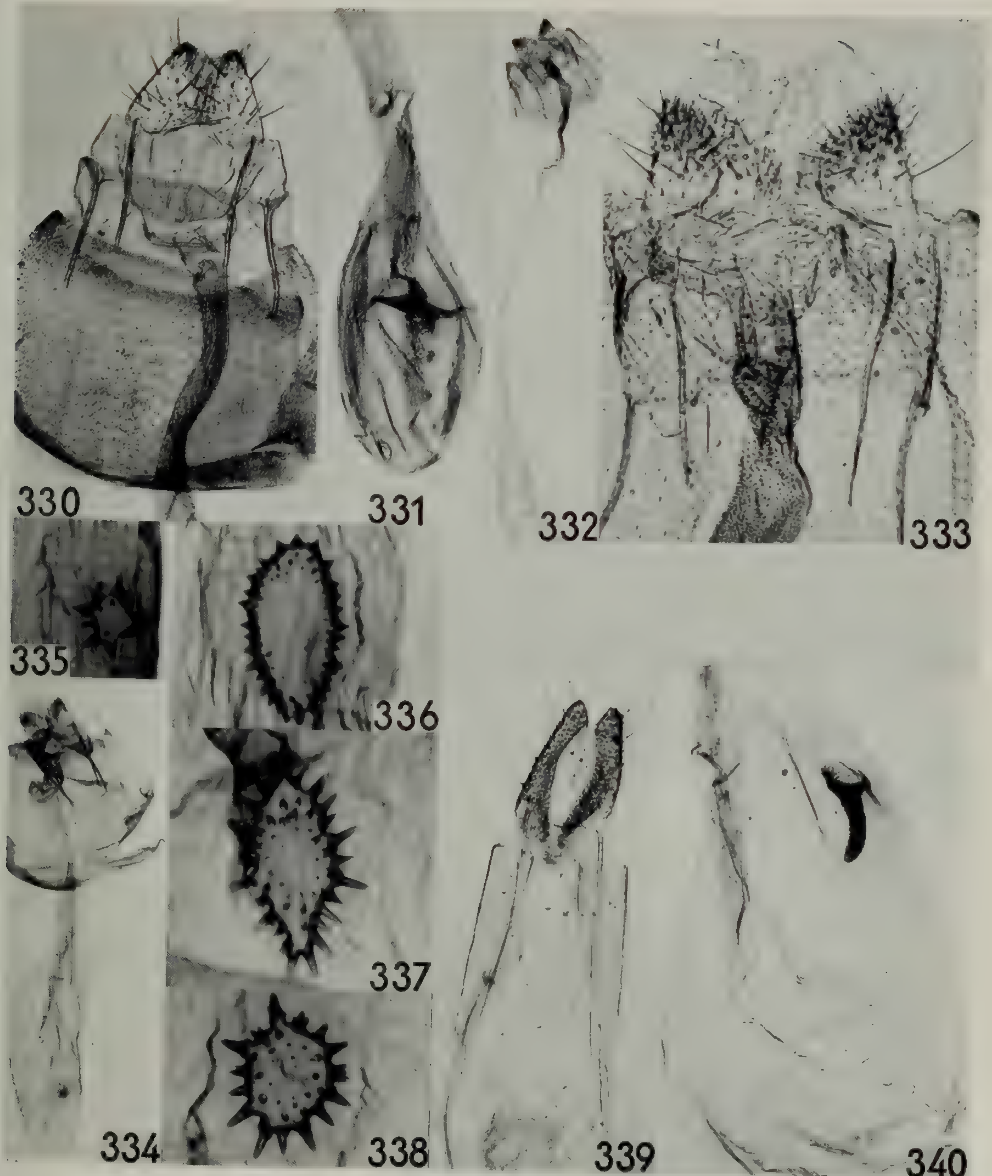
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PLATE 58

FIG. 348. *Tridesmodes ramiculata* Warren.
FIG. 349. *Tridesmodes ramiculata* Warren. (Ostium.)
FIG. 350. *Epaena trijuncta* (Warren).
FIG. 351. *Epaena trijuncta* (Warren). (Ostium.)
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FIG. 355. *Epaena pellucida* sp. n. (Anal papillae and ostium.)

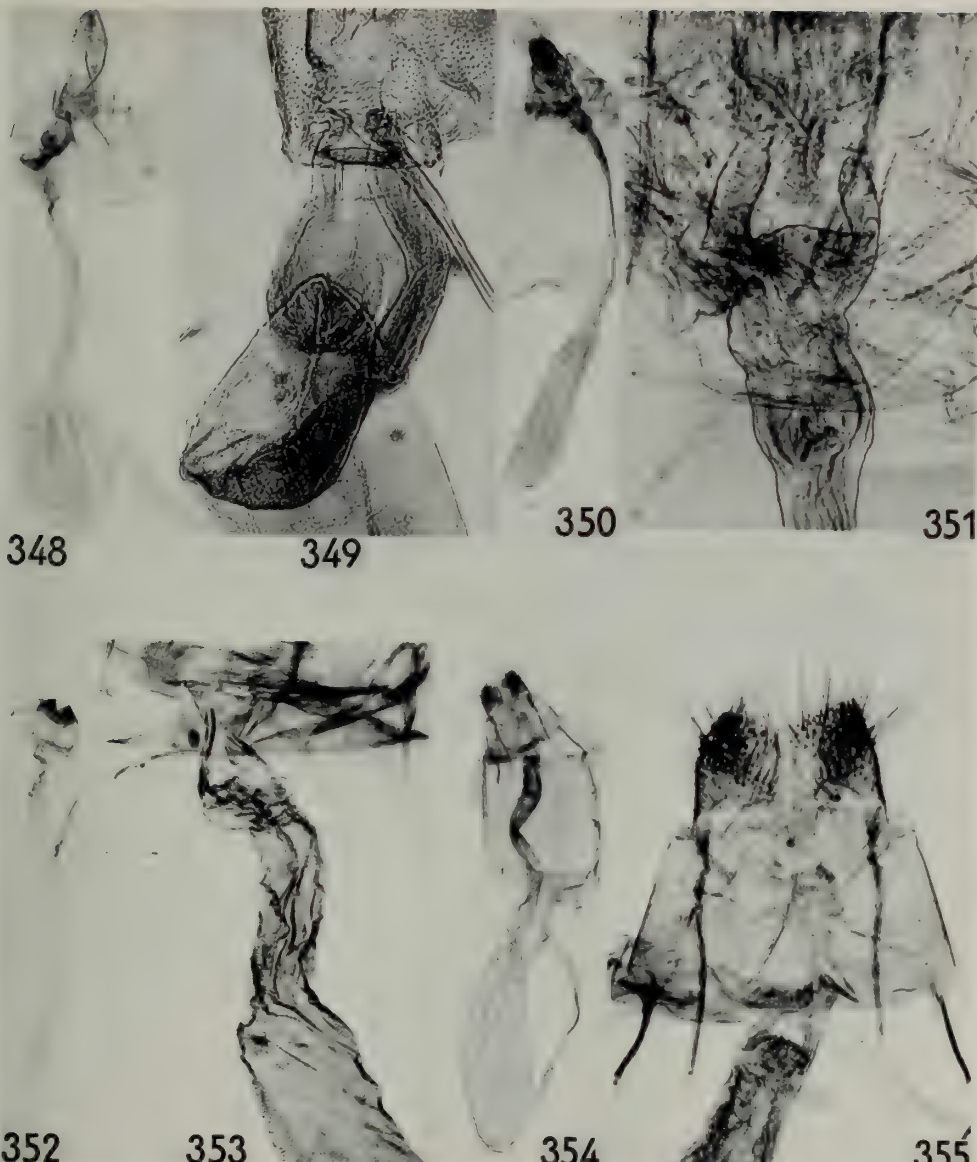
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PLATE 59

FIG. 356. *Epaena danista* sp. n.
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FIG. 363. *Collinsa subscripta* Warren. (Ostium.) (Photo P. Whalley.)


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PLATE 60

FIG. 364. *Kuja gemmata* (Hampson).
FIG. 365. *Kuja gemmata* (Hampson). (Anal papillae and ostium.)
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FIG. 372. *Kuja effrenata* sp. n. (Ostium.)

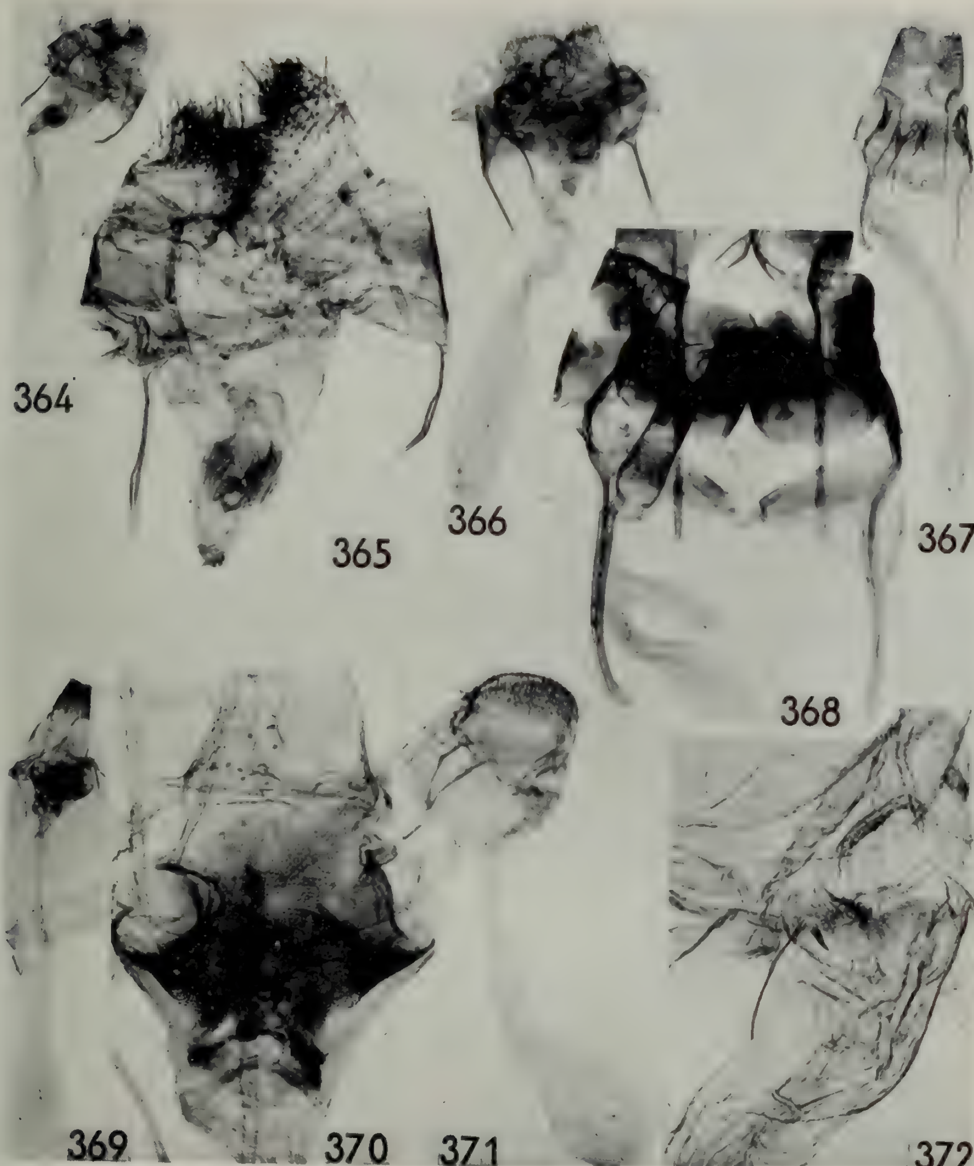

PLATE 61

FIG. 373. *Kuja majuscula* Gaede.
FIG. 374. *Kuja majuscula* Gaede. (Bursa.)
FIG. 375. *Hypolamprus curvifluus* (Warren).
FIG. 376. *Hypolamprus curvifluus* (Warren). (Signum.)
FIG. 377. *Hypolamprus curvifluus* (Warren). (Signum.)
FIG. 378. *Hypolamprus curvifluus* (Warren). (Signum.)
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FIG. 380. *Hypolamprus districtus* sp. n. (Ostium.)
FIG. 381. *Hypolamprus districtus* sp. n. (Bursa.)

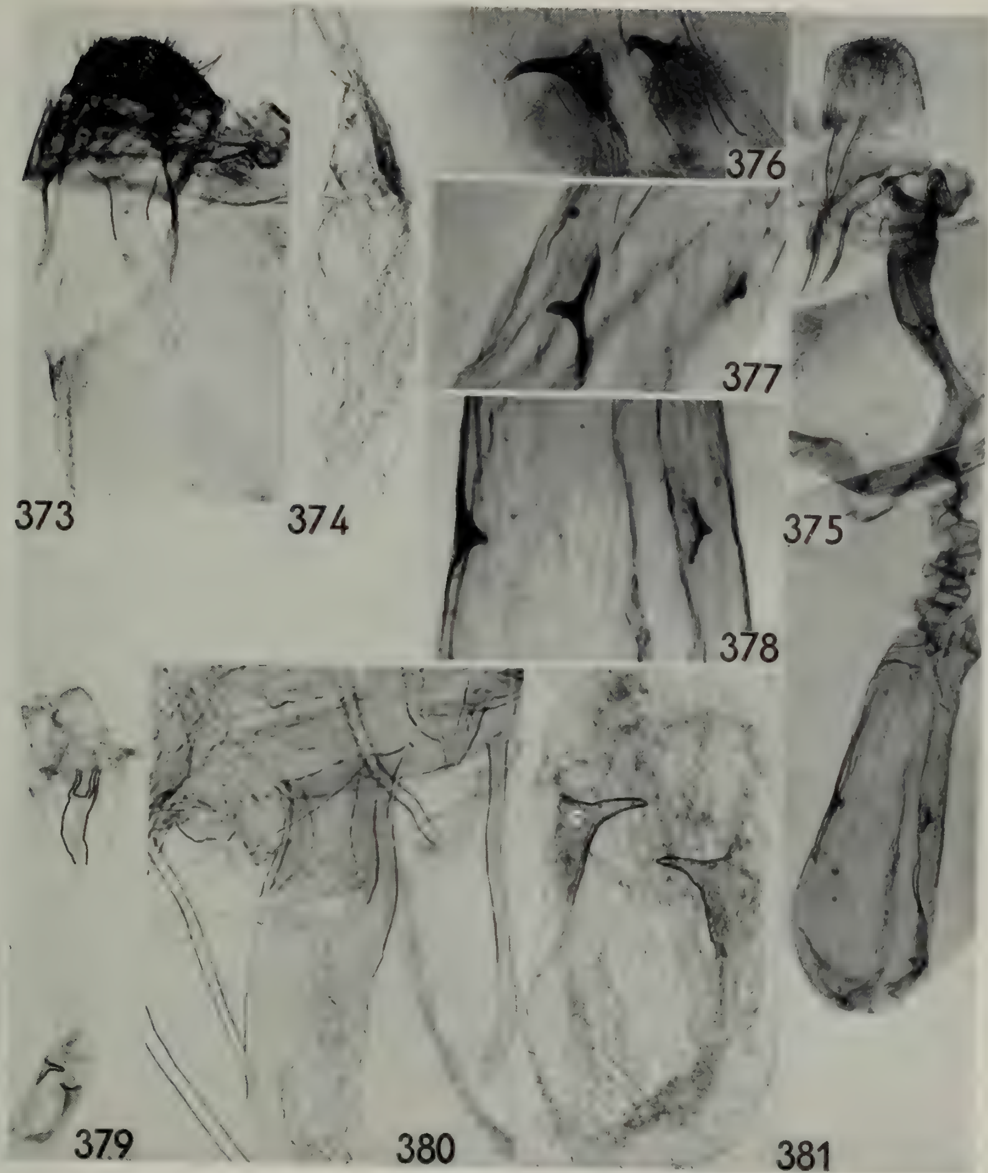
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PLATE 62

FIG. 382. *Hypolamprus janenschi* (Gaede).
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FIG. 385. *Hypolamprus gangaba* sp. n. (Ostium.)
FIG. 386. *Hypolamprus gangaba* sp. n. (Signum.)
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FIG. 390. *Cornuterus paratrivius* sp. n. (Bursa.) (Photo P. Whalley.)

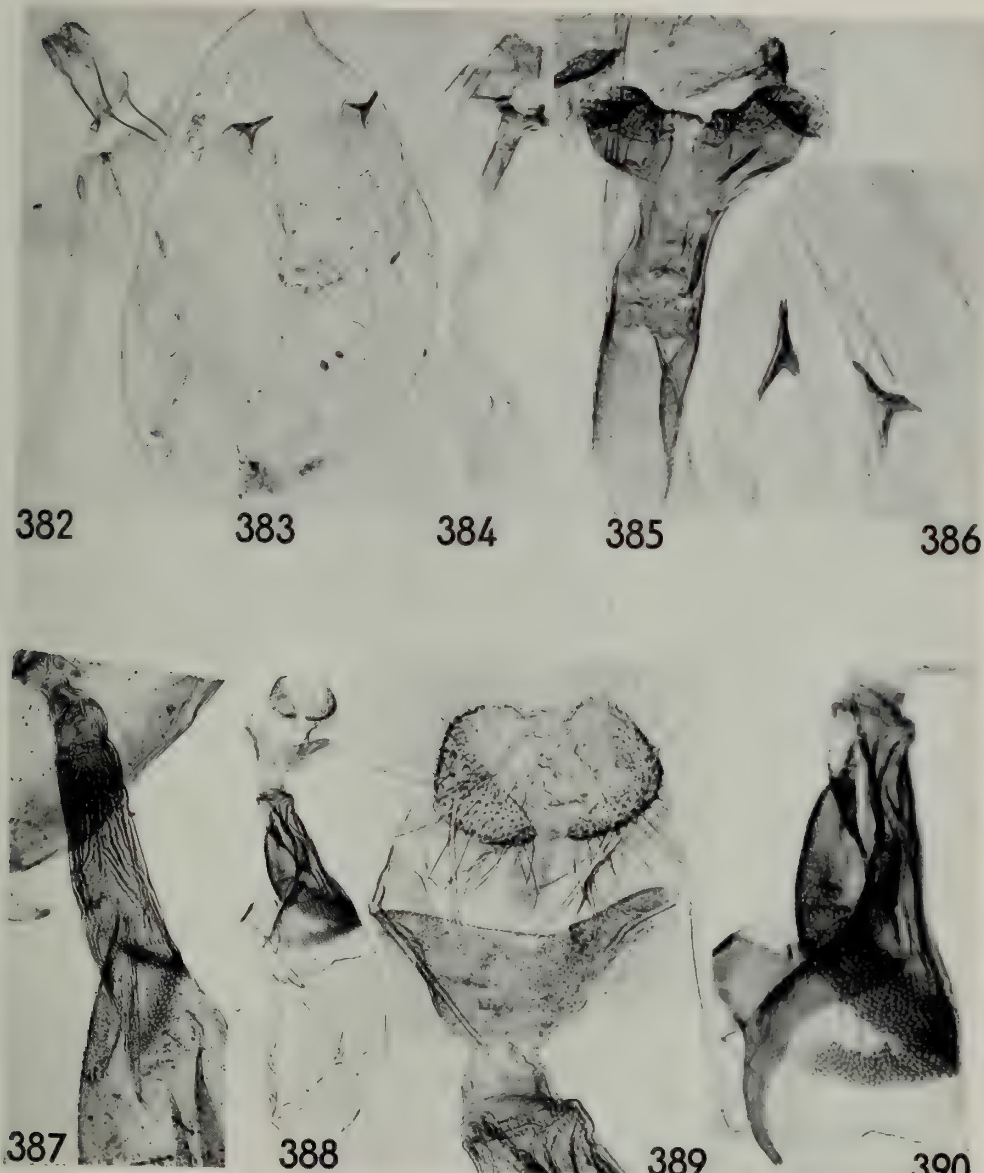
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PLATE 63

FIG. 391. *Bupota tranquilla tranquilla* ssp. n.
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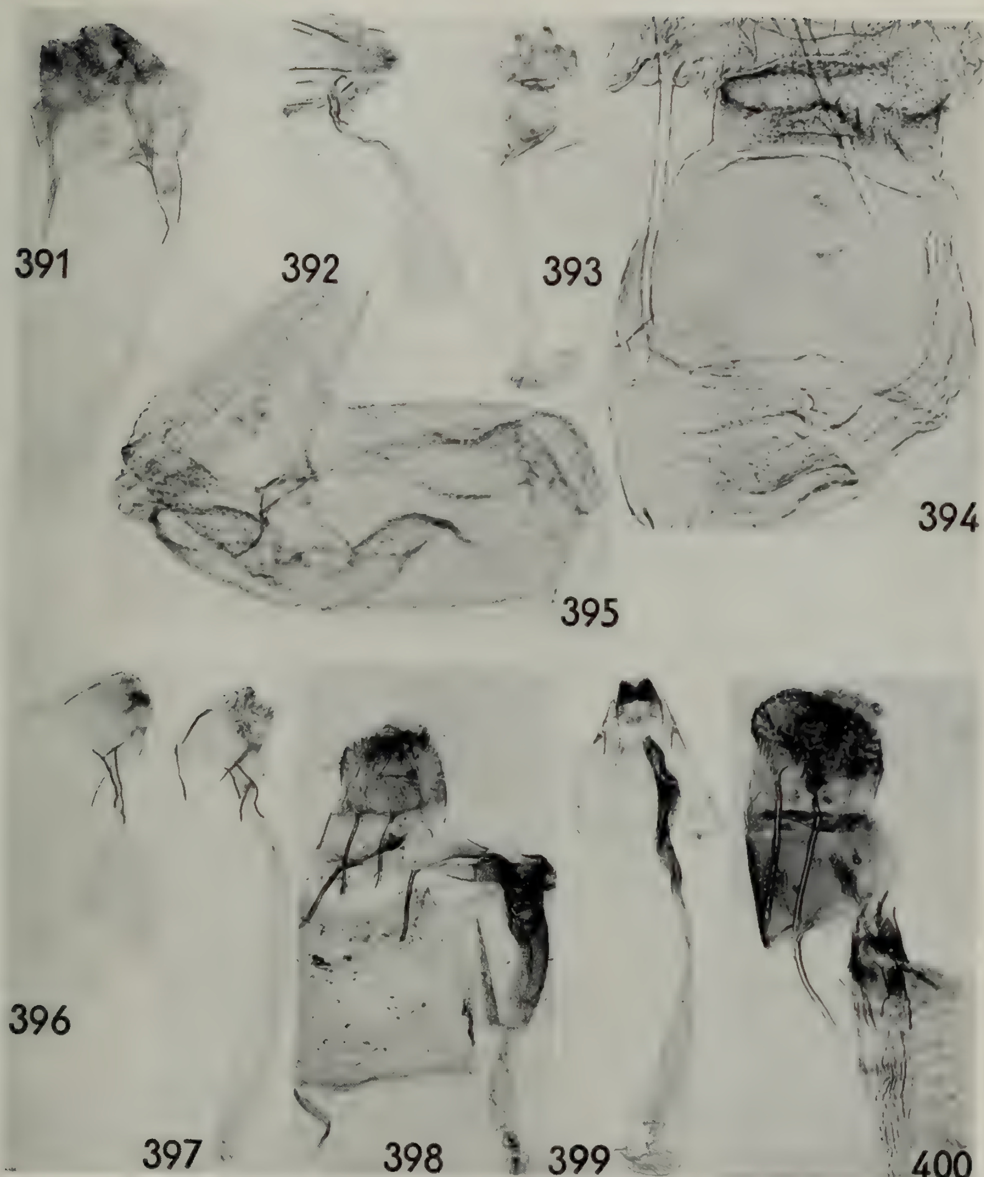
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PLATE 64

FIG. 401. *Nemea eugrapha* (Hampson).
FIG. 402. *Nemea eugrapha* (Hampson). (Ostium.)
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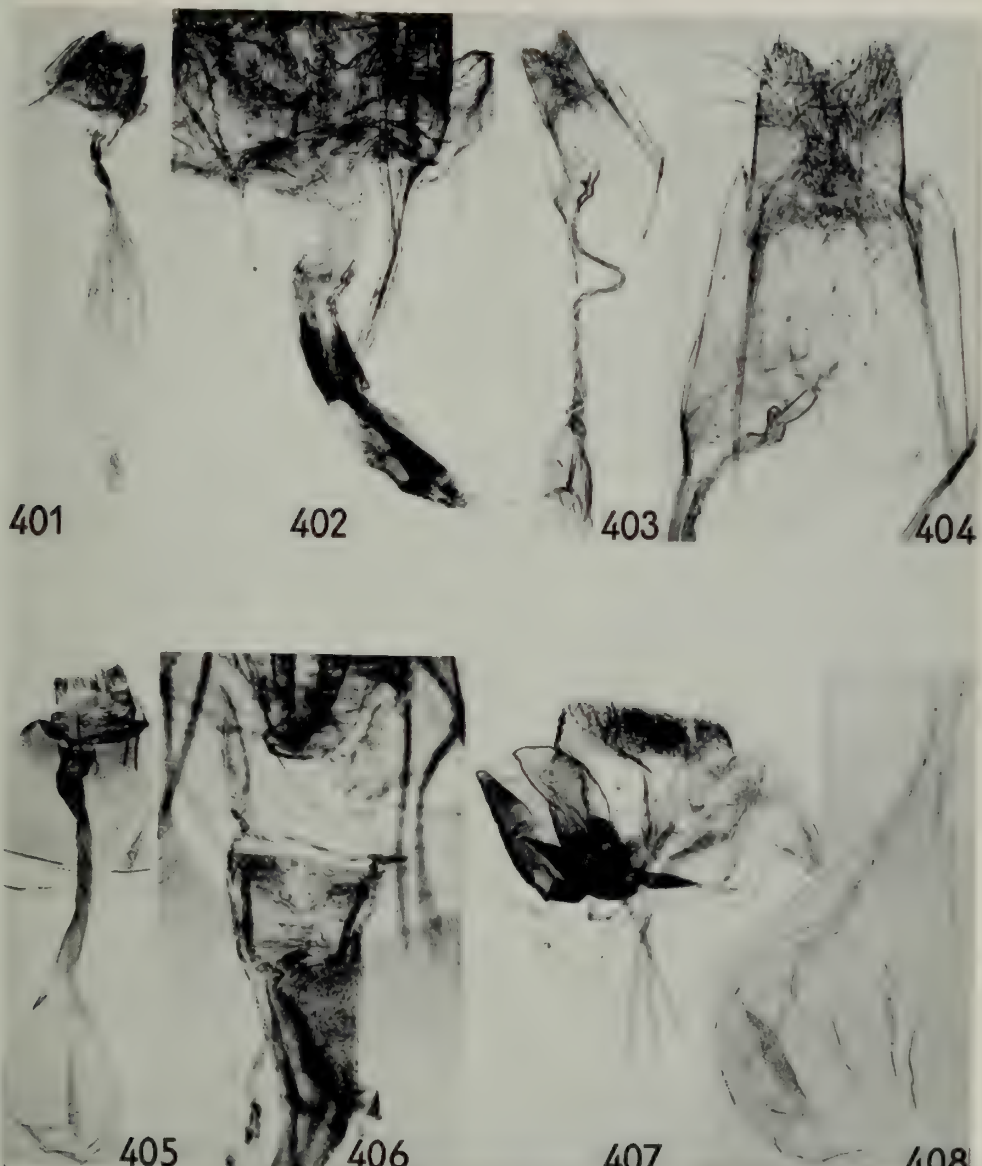
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PLATE 65

Fig. 409. *Sijua jejunalis* (Gaede).
Fig. 410. *Sijua jejunalis* (Gaede). (Bursa.)
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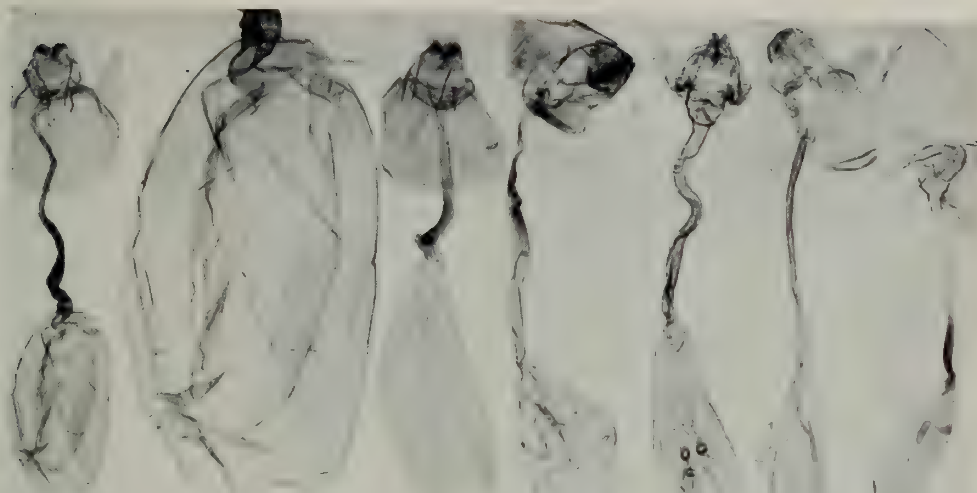

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PLATE 66

FIG. 420. *Sijua canitia* sp. n.
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FIG. 423. *Opula impletalis* Walker. (Signum.)
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PLATE 67

FIG. 429. *Opula monsterosa* sp. n.
FIG. 430. *Opula monsterosa* sp. n. (Bursa.)
FIG. 431. *Opula monsterosa* sp. n. (Signum.)
FIG. 432. *Lelymena misalis* Karsch.
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FIG. 434. *Sinecalca insolita* sp. n.
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FIG. 436. *Cecidothyris longicorpa* sp. n.
FIG. 437. *Cecidothyris longicorpa* sp. n. (Anal papillae and ostium.) (Photo P. Whalley.)

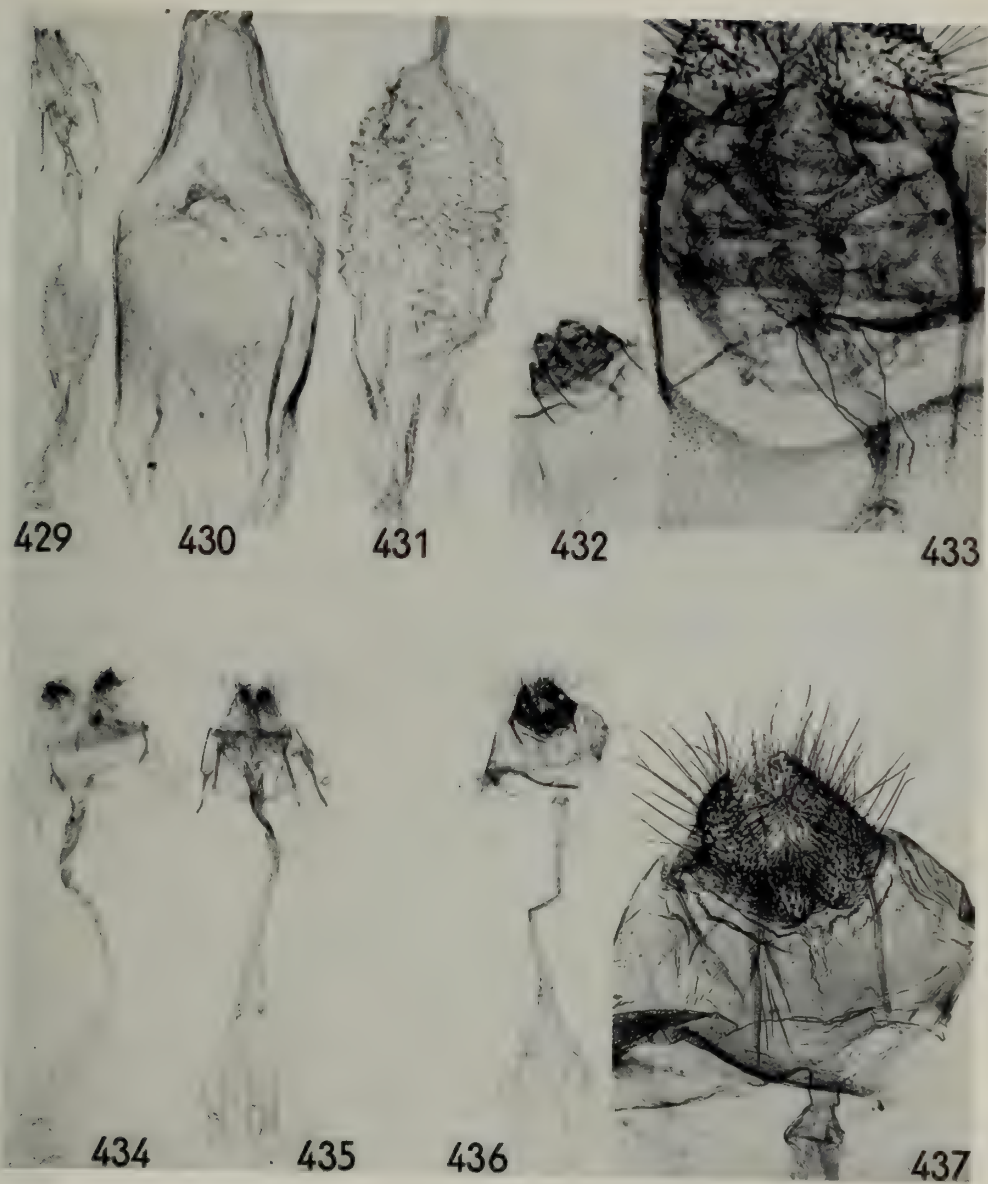

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FIG. 438. *Cecidothyris pexa pexa* (Hampson).
FIG. 439. *Cecidothyris pexa pexa* (Hampson). (Ostium.)
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THE SOLDIERLESS TERMITES OF AFRICA (ISOPTERA : TERMITIDAE)

W. A. SANDS

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Supplement 18
LONDON : 1972

THE SOLDIERLESS TERMITES OF AFRICA (ISOPTERA: TERMITIDAE)

BY

WILLIAM ALEXANDER SANDS

Centre for Overseas Pest Research

9 *Plates*, 661 *Text-figures*

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Supplement 18
LONDON : 1972

A

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THE SOLDIERLESS TERMITES OF AFRICA (ISOPTERA: TERMITIDAE)

By W. A. SANDS

CONTENTS

SYNOPSIS

The soldierless termites from the African continent, hitherto all included in the genus *Anoplotermes*, are fully revised. They are shown to belong to the subfamily Apicotermitinae, which is expanded to include all related forms. The subfamily Amitermitinae, in which they were previously classified, becomes a junior synonym of Termitinae. Sixty species (51 new) and 16 genera (all new) are recognized. Seven specific names are found to be synonymous and two species previously assigned to *Anoplotermes* are transferred to genera in other groups of termites. Keys are given to genera and species, and the phylogeny of the whole family Termitidae is discussed. The classification adopted is based largely on the results of multivariate analyses of coded characters and measurements, but is modified to conform to conventional standards where necessary.

INTRODUCTION

This work was begun as a revision of the African species of the genus *Anoplotermes*. These soldierless termites have long been known throughout the tropical parts of the continent as common inhabitants of the soil and the mounds of other groups of termites. Ecological observations by Kemp (1955), Harris (1963) and Sands (1965*a*) have shown that they are among the most important constituents of the soil fauna, being second only in abundance to *Microtermes* (Macrotermitinae). They are not distinguished by any striking external feature other than the absence of a soldier caste, and have often been confused with other Termitidae, sometimes widely unrelated. In the course of the study it soon became clear that more than one genus was involved. With few exceptions they feed on soil and superficially look very like various Termitinae and Nasutitermitinae with the same habit. One slight difference from the majority of these is visible only in the live insects, that is the curious transversely striped appearance of the abdomen as the worker moves about. It arises from the folding of the thin translucent cuticle over the powerful transverse and longitudinal muscles that produce the phenomenon referred to in subsequent sections as abdominal dehiscence. This is not universal in the soldierless termites, but in Africa there are few exceptions. When molested by predators such as ants, or when grasped by forceps and placed in alcohol, the abdominal muscles contract convulsively and the abdomen ruptures across a line of weakness behind the first tergite. The intestines erupt through the gap and themselves tend to burst, scattering their slimy contents. This reaction is elicited even when the termite is only held to the substrate by the extreme tip of an appendage such as the tarsus; no contact with or pressure on the abdomen is required to set off the mechanism. Fragility of the body wall and intestines as a defensive mechanism against Doryline ants in *Cubitermes* was noted by Williams (1959). There is no doubt that the contents of the worker hind gut of many soil-feeding termites are offensive to ants. *Speculitermes* in India have been observed by the present author to whip the tip of the elongated mobile abdomen forwards to deposit a blob of rectal contents on the head of a predator. The same response was elicited to the collector's forceps. No such behaviour has yet been recorded from Africa but the alternative suicidal defence of abdominal dehiscence has developed to a high degree. In some genera the sclerotized spiny armature of the enteric valve appears to form a linking structure between the two sections of the hind gut. This probably prevents the rupture at the valve from taking place too easily, as it is apt to do in less specialized forms. In *Ateuchotermes* the link snaps across the narrower part of its sclerotized stem when pulled hard enough. In some *Anenteotermes* the dual link has a click-over action, again giving way suddenly to excess tension. These parallel though distinct mechanisms may result in a build-up of hydrostatic pressure and a correspondingly more devastating defensive explosion when the release occurs. A similar suicidal type of defence has been observed in Neotropical species of *Anoplotermes* (A. Mathews, personal communication). The rarity of the soldier caste in *Speculitermes* and its absence in other genera attests the effectiveness of these methods of deterring predators.

Their very lack of a soldier caste has led to this group of termites being regarded

as an intractable taxonomic problem, avoided by most systematists. This accounts for the small number of species described and the paucity of material in collections. Eleven species were previously included in the genus from Africa. The holotype, syntypes and paratypes of all these have been examined and lectotypes selected and designated where necessary. Of the named species of *Anoplotermes*, *A. lateralis* (Walker) is in fact a *Microcerotermes*, and *A. pallidipes* (Sjöstedt) is a *Pericapritermes*. *A. placidus* Silvestri, *A. sanctus* Silvestri and *A. sedatus* Silvestri all become junior synonyms.

The nomenclatural adjustments resulting from the removal of two species to other genera are set out formally below.

Microcerotermes lateralis (Walker) **comb. n.**

Termes lateralis Walker, 1853 : 523. Holotype imago, sex indeterminable, SIERRA LEONE, in BMNH.
Anoplotermes lateralis (Walker); Silvestri, 1914 : 65.

Pericapritermes pallidipes (Sjöstedt) **comb. n.**

Eutermes pallidipes Sjöstedt, 1900 : 172. Syntype imagos, CAMEROON: Kribi, in Zoologisches Museum, Berlin.
Anoplotermes pallidipes (Sjöstedt); Sjöstedt, 1926 : 289.

To the remaining six of the original species have been added three species-names initially placed in genera of Termitinae, and now found to belong to this group. The type-species of these too have been examined and lectotypes designated. These changes are not unusual and no more than were anticipated. The unexpected feature of this work has been the discovery of a complex of 60 species for which both imago and worker castes are available. None of these or the earlier species can be attributed to *Anoplotermes*, which is a genus confined to the Neotropical region (an Indian species described by Roonwal and Chhotani (1960) is unlikely to be congeneric with the type-species, *A. pacificus* Muller).

The African species are now divided into 16 genera of which eight are monotypic, two have two species, and the remainder have three, four, six, eight, 10 and 17 species respectively. This pattern of subdivision is similar to that found in the subfamily Nasutitermitinae for the same region by Sands (1965). Many of the species described here have to be based on single nest-series owing to shortage of specimens. Only in the commonest species is there abundant material to establish the range of variation. Where closely related forms collected from widely separated localities differ in some characters, they are treated as distinct species until intermediates are found. Some species now recognized may consequently be future synonyms. On the other hand the alates are feeble fliers with poor dispersive powers and local speciation seems to have been frequent. A number of distinct species are known from the worker caste alone. These are not named because in a group as difficult as this it is advisable to have all castes before descriptions are formally made. The existence of more species shows that the work is not complete for Africa, whilst for other zoogeographical regions the group has scarcely been touched.

The importance of the soldierless termites as soil-working organisms in the Tropics is evident. The new information on their morphology raises the question of the adequacy of the existing subfamilial classification. The confusion this arouses is illustrated by the discussion of their relationships by Roonwal and Chhotani (1966). This confusion can be resolved by certain alterations which are discussed in detail in the section on phylogeny. The soldierless forms and their relations are removed from the Amitermitinae and placed in the Apicotermitinae. The subfamily allocation is therefore omitted from the title to this paper.

In order to emphasize the uniformity of the soldierless termites, and their relationship to *Anoplotermes*, the first-named member of the group, all the generic names used here begin with the same letter. This was achieved by the choice of names expressing their unarmed, passive condition.

MATERIAL

A total of 598 nest-series are listed in this revision. These represent about 95 % of the material examined, the remainder being of single castes that do not match any of the recognized species.

Much of the material has been collected by members of the Termite Research Unit (Ministry of Overseas Development) and is deposited at the British Museum (Natural History). Types and other specimens have been obtained on loan, through the courtesy of specialists and others mentioned in the acknowledgements from the following museum collections:

Naturhistoriska Riksmuseum, Stockholm; Silvestri collection, Instituto di Entomologia Agraria 'Filippo Silvestri', Portici, Naples (Silvestri Coll., Ist. Ent. Agr.); American Museum of Natural History, New York (AMNH); National Collection of Isoptera, Plant Protection Research Institute, Pretoria (N.C.I., Pretoria); Musée Royal de l'Afrique Centrale, Tervuren; Swiss Tropical Institute, Basle; University of Lovanium, Kinshasa.

The abbreviations given in parentheses are those used in the text. The British Museum (Natural History), where abbreviated, is given as BMNH. In listing localities, co-ordinates are given for those not included in the gazetteer of the *Times Atlas*, vol. IV, 1958 edition.

METHODS

Characters used

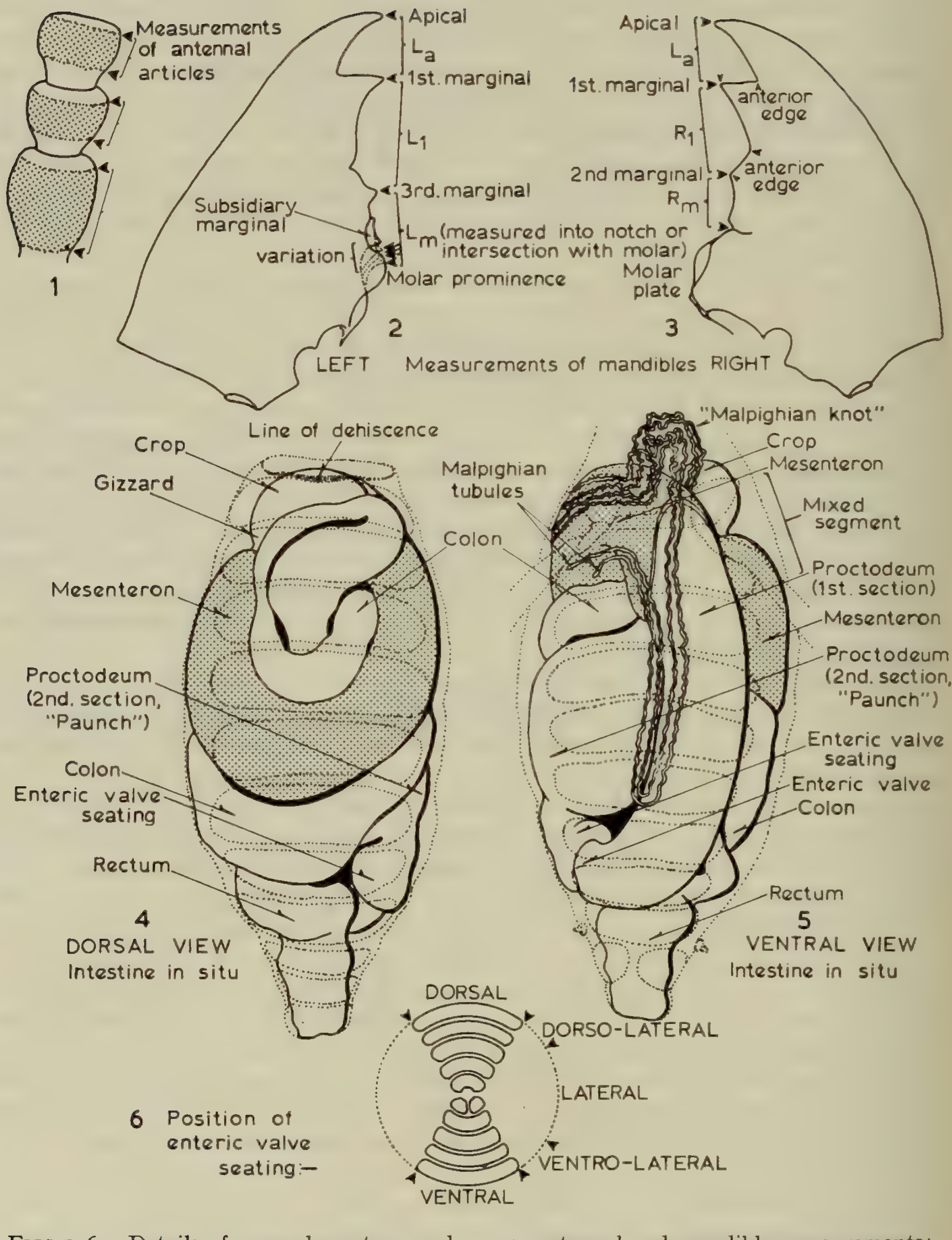
In attempting a comprehensive study of a group previously almost unknown, a careful search for suitable characters has had to be made. In the imago caste most of the more prominent external features have been used or illustrated before. However, some features have been found more important than previously recognized, and the value of some small details of structure more fully realized. The mandibles of both imago and worker castes have been subjected to detailed measurements. A small subsidiary marginal tooth on the left mandible, between and behind the third marginal and the molar prominence has been found to provide an important generic character. Silvestri (1913–14) illustrated the imaginal meso- and metanota but was only interested in the shape of their hind margins. These are of little taxo-

nomic value, but the width of the narrowest part between the wing processes of both nota is important. The presence or absence of a dark sclerotized suture at this point, the internal attachment of the oblique lateral dorsal muscles, is a further character. The 'medial frons spot' of Fuller (1925) lies immediately in front of the fontanelle and is the attachment of the medial muscle of the labrum. It is sometimes raised or depressed, and will be referred to simply as the medial spot. A pair of crescent-shaped or semicircular smooth marks between the ocelli and the posterior margin of the postclypeus were named 'antennal organs' by Holmgren (1909). Whatever their morphological origins, this name seems confusing and they will be referred to here as frontal marks. The antennae always have 15 articles in imagos and 13 in workers.

A considerable range of measurements of both imago and worker castes has been undertaken. These will be referred to again in the sections on multivariate methods. Although the analyses of measurements were done first, they are described after the multivariate similarity study based on coded characters. This is done because the latter follows on more naturally from the description of the non-measured characters. In listing measurements in the species descriptions, the limits of the range are rounded off to two decimal places. Where more than two specimens were measured a mean value was calculated and when measured series numbered five or more specimens the standard deviation is also given. These calculated values are given to three places of decimals. Where the rounded figures for the range coincide they are omitted and only the mean given. A single figure in the range column indicates invariance in the character for the specimens measured, in which case no mean is given.

In the worker caste a new set of characters based on features of internal anatomy is used. The existence of a histologically mixed segment in the digestive tract at the junction of the mid-gut and the hind-gut in the worker castes of the Termitidae was first demonstrated by Sutherland (1934). This author was also led by the appearance of its spiny armature to assume that the enteric valve functioned as a second 'gizzard'. The enteric valve is found in all termites where the first part of the hind gut enters or connects with the large pouch of the second, posterior part, sometimes referred to as the 'large intestine'. Grassé and Noirot (1954) studied in more detail the anatomy of the mixed segment and the enteric valve of a number of Termitidae, and pointed out the value of these characters in the systematics of the group. The differences in intestinal anatomy led them to propose separating certain genera in a new subfamily, the Apicotermitinae. Noirot and Kovoor (1958) carried the investigation of the gut in the Termitinae further and discussed its phylogenetic implications. Recently Noirot (1966) has included descriptions of the gut of the worker in describing two new Amitermitinae. Noirot and Noirot-Timothée (1969) summarized the available information on the intestine of all termite families and Kovoor (1969) has carried out a more detailed study of the Nasutitermitinae that confirms the great importance of these characters in interpreting the phylogeny.

The detailed anatomy of the gut has not previously been investigated in the soldierless termites, but it forms an indispensable part of this revision. There is



FIGS 1–6. Details of some characters used. 1–3, antennal and mandible measurements; 4 & 5, worker caste abdomen-layout of intestine in situ; 6, meaning of terms used in description of enteric valve seating.

great variation in the length of the mesenteric overlap with the proctodeum, that is, the mixed segment, and its position related to that of the malpighian tubules provides both generic and specific characters. The enteric valve has a highly variable degree of armature and development and again provides both generic and specific characters. Its attachment to the pouch of the posterior part of the hind gut is modified in some genera by the development of part of the pouch into a tubular neck terminating in a more or less bilobed or trilobed valve-seating. This is usually visible through the body wall of an unopened worker termite, and its position is determined by the length and coiling of the various parts of the gut. The position of this structure can be stated relative to adjacent sternites or tergites and so provides a further useful character (Text-fig. 6). In some species the 'lobes' of the valve seating are developed into distinctive diverticula. Although some of these features can often be seen through the body wall, it is usually better to sacrifice a specimen to see them clearly. To examine the armature of the enteric valve a dissection and slide preparation are essential. Finding these structures and dissecting them out is not always easy and a more detailed description of the gut is needed. A diagram of dorsal and ventral views of a typical worker termite of this group is given in Text-figs 4 & 5. In dorsal view the long oesophagus traverses the narrow thoracic segments to open into the sac-like crop with the relatively feebly developed gizzard at its distal end. This is found beneath the foremost abdominal tergites and rests above and in front of one or two coils of the narrow part of the hind-gut. The wide and thicker-walled mid-gut (mesenteron) leads from the gizzard at first backwards on the left hand side in a loop round the outside of the coil of hind-gut (proctodeum) passing forwards and downwards on the right towards the ventral side. Viewed from the ventral side the mid-gut appears on the left leading forwards and across the front of the abdomen, just behind the posterior pair of legs. The loop of the gut passes across to the right, and the junction with the hind-gut is found in this region. The thin-walled hind-gut passes down the right hand side of the abdomen, and at the distal end crosses over to the left. Here it narrows to enter the enteric valve or passes round to the left lateral or dorsal side before reaching the valve, according to the proportions of the various parts of the gut. The pouch of the proctodeum beyond the enteric valve leads forward again to the coil within the mesenteric loop, and thence beneath this loop down the dorsal side to the dilated rectum. The junction between mid- and hind-gut may be simple, or overlapping as already stated to form a mixed segment of variable length. The four malpighian tubules severally enter the inner side of the mid-gut on the left in ventral view. They first loop backwards over the second pouch of the hind-gut and then pass forwards over the mixed segment into a tangled knot, which often extends into the distal part of the thorax under the hind coxae. This structure will be referred to as the 'malpighian knot'. From the malpighian knot the tubules spread out over the mid-gut and gradually become thinner to their ends, which loop back over the mixed segment and other parts of the gut. The function of the malpighian knot is unknown but it serves as a useful landmark in measuring the development of the mixed segment and as a recognition feature for this group of termites. No other group has the gut coiled in this precise way, which is thus

absolutely characteristic of the soldierless termites in Africa. The mixed segment, when present, always consists of a single extension of the mid-gut around the inner curve of the loop, with a corresponding extension of hind-gut round the outer curve. This is the reverse of all other groups, and will be discussed further in the section on phylogeny.

The dissection of the worker caste to obtain a clearer view of these structures is a simple matter. All that is needed is to pinch up the body wall of the ventral side near the hind coxae with fine forceps, and to tear it back towards the rectum. The pleural membranes rupture more or less evenly leaving the gut exposed. The ventral nerve cord and any residual muscle coats can then be picked off very quickly.

The other structure requiring more detailed description is the enteric valve. Its position has already been indicated. It can be dissected out by gripping the pouch beyond the valve seating, and the first part of the proctodeum anterior to the valve, with forceps. The valve can then be gently pulled out of its seating and detached from the proctodeum as a roughly conical stump with the valve armature inside its truncated apex. Repeated gentle pressure will expel the contents, and the valve can be mounted whole and cleared in one operation. For this purpose the variant of Gum chloral commonly known as 'Swan's Berlese' has proved completely satisfactory. The armature is easier to see if the valve is slit down one side with a fine blade and opened out, as shown in many of the plates. The valve, as described by Grassé and Noirot (loc. cit.) consists of longitudinal rounded ridges or cushions ('bourrelets') which carry a variety of spines and sclerotizations. In some genera these are such as to render the term 'cushion' inappropriate, but it is used throughout this paper to indicate the homology of the parts and avoid confusing circumlocutions. In a few species the thin membranous wall between the cushions also shows small scales or carunculations that bear fringes of spicules of varying size. These can usually only be seen at high magnifications with phase contrast illumination, and are not therefore intended as key or diagnostic characters except when very conspicuous. However they are of phylogenetic interest and so are included in descriptions and used for multivariate similarity studies. For the latter purpose, it was necessary to express the variation of each character in coded form, as dichotomies, multi-state qualitative characters, or as ranked or continuous quantitatives (measurements). The similarity analysis utilized species as O.T.U's with the objective of clarifying generic groupings. In theory, the characters are used without prior weighting, but it is inevitable in the process of coding that the logical structure of certain 'gross' characters necessitates their breakdown into a number of smaller units. This results in some centres of anatomical variation being represented by many more or less independent characters and so being weighted in the overall consideration of phenetic affinity. Such weighting seems intuitively to be natural, and might even to some extent be thought to reflect genetic complexity though there is of course no way of assessing this at present. An example of such a feature is the enteric valve in which 34 coded characters were required to express its variations in form. On the other hand some characters, such as the length of the mixed segment, appear to be under-represented because they do not lend themselves readily to logical breakdown. This feature is probably of considerable

adaptive importance, and where widely and consistently different is a useful character delimiting genera. Without deliberate weighting by arbitrary subdivision it only produced two coded characters, one alternative and one ranked quantitative. This may be an argument for the coding of all characters as dichotomies. Colour characters were treated quantitatively rather than qualitatively since in these termites colour is only a matter of progressive sclerotization and ranges from white to black through yellow and brown. In an earlier work (Sands, 1965) an arbitrarily decided scale of intensity employing 12 terms was used, and the same procedure was followed here. It was a simple matter to give these numerical values on the assumption that dark brown is more similar to brownish black than is pale brown. In a situation where different pigments are found, a qualitative treatment would be required but in the present case the quantitative approach seemed most appropriate.

Measurements of various body parts of both imago and worker castes were also included in the list of characters. An attempt was made to avoid excessive weighting of the general size factor by employing only those measurements that received large positive or negative loadings in principal components and canonical variates analysis. These are discussed in more detail in a later section. Multivariate methods of handling large numbers of measurements or attributes of organisms have been known for several decades and described in several textbooks (Kendall, 1957; Harman, 1960; Cooley & Lohnes, 1964; and Seal, 1964).

Multivariate similarity analysis

In recent years many taxonomic works have been published that make use of these methods and they have come to be recognized as a regular part of the technical armoury of the systematist. For this reason no list of references to individual papers is given apart from the textbooks mentioned above.

A total of 99 coded numerical characters was used for multivariate analysis by means of the classification programme (CLASP) devised by J. C. Gower on the basis of a method originally suggested by P. A. Sneath. It was carried out on the Orion Computer at Rothamsted Experimental Station, Harpenden, Herts. The list of characters is given below:

Qualitatives:

(i) *Alternatives*

(1) Shape of posterior margin of imago head capsule
(2) Shape of posterior margin of imago postclypeus
(3) Pilosity of imago head capsule; presence or absence of a 'pelt'
(4) Thickening of mesonotum between wing processes of imago present or absent
(5) Thickening of metanotum between wing processes of imago present or absent
(6) Median 'suture' of imago postclypeus present or absent
(7) Frontal marks of imago head capsule depressed or flat

(8) Pilosity of imago head capsule sparse, fine or inconspicuous, or more numerous and coarser

(9) 'Abdominal dehiscence' in worker caste present or absent

(10) Mixed segment of worker gut with or without inflated section at distal end

(11–14) Enteric valve of worker gut: sclerotization of cushions present or absent (each of four independent positions)

(15–18) Enteric valve: position of spines of main armature on cushions, proximal third, present or absent. ('Main armature' refers to scales or spines at least one place higher in rank under characters 88–91 than remainder. If spines uniform then all scored zero here)

(19–22) Enteric valve: spines of main armature present or absent in mesal third

(23–26) Enteric valve: spines of main armature present or absent in distal third

(27) Enteric valve: membranous wall between and beyond cushions smooth, or caruncula te or scaly

(ii) *Multi-state qualitative*

(28) Fontanelle of imago: shape; circular, short oval or elongated

(29) Fontanelle of imago: level; depressed, flat, or slightly raised

(30) Fontanelle of imago: size; vestigial, less than ocellus or more than ocellus

(31) Medial spot of imago (i.e., small spot just anterior to fontanelle); shape (as above)

(32) Medial spot of imago: level as above

(33) Medial spot of imago: size; less than, equal to, or more than fontanelle

(34) Frontal marks of imago (between ocelli and postclypeus); shape, indistinct or vestigial, crescent-shaped, or semicircular

Quantitative:

(i) *Continuous variables* (measurements)

(35) Imago: width of head capsule across compound eyes (W)

(36) Imago: least diameter of ocellus (O_w)

(37) Imago: greatest diameter of ocellus (O_l)

(38) Imago: distance ocellus to compound eye (O–E)

(39) Imago: length of postclypeus (maximum) (Pcl)

(40) Imago: length of antennal article 3 (III) (Text-fig. 1)

(41) Imago: length of antennal article 4 (IV)

(42) Imago: left mandible, distance from apical to first marginal tooth (L_A) (Text-fig. 2)

(43) Imago: left mandible, distance from first to third marginal (L_l)

(44) Imago: left mandible, distance from third marginal to end of subsidiary tooth (L_m)

(45) Imago: right mandible, distance from apical to first marginal tooth (R_A) (Text-fig. 3)

(46) Imago: right mandible, distance from first to second marginal (R_l)

(47) Imago: right mandible, distance from second marginal to notch between it and the molar plate (R_m)

(48) Imago: width at narrowest part of mesonotum between wing processes (M)
(49) Imago: width at narrowest part of metanotum between wing processes (N)
(50) Worker: width of head capsule (W)
(51) Worker: width of fore tibia (T_w)
(52) Worker: length of fore tibia (T_l)
(53) Worker: length of postclypeus (Pcl)
(54) Worker: left mandible, distance from apical to first marginal tooth (L_A)
(55) Worker: left mandible, distance from first to third marginal (L_l)
(56) Worker: left mandible, distance from third marginal to end of subsidiary tooth (L_m)
(57) Worker: right mandible, distance from apical to first marginal tooth (R_A)
(58) Worker: right mandible, distance from first to second marginal (R_l)
(59) Worker: right mandible, distance from second marginal to notch between it and the molar plate (R_m)

(ii) *Ranked quantitatives*

(60) Imago: left mandible, state of subsidiary tooth
(61) Imago: fore tibia, state of third apical spur
(62) Imago: head capsule colour
(63) Imago: postclypeus colour
(64) Imago: colour of ocellar patch or streak
(65) Imago: fontanelle colour
(66) Imago: medial spot colour
(67) Imago: colour of middle articles of antenna (VIII, IX, X)
(68) Imago: colour of frontal marks
(69) Imago: femora colour
(70) Imago: tibiae colour
(71) Imago: colour of tarsi
(72) Imago: colour of abdominal tergites
(73) Imago: dorsal abdominal stigmata colour
(74) Imago: abdominal sternites, colour of lateral parts
(75) Imago: abdominal sternites, colour of middle parts
(76) Imago: colour of ventral abdominal stigmata
(77) Imago: colour of cerci
(78) Worker: left mandible; state of subsidiary tooth
(79) Worker: fore tibia; state of third apical spur
(80) Enteric valve: position of valve seat in unopened worker abdomen (Text-fig. 6)
(81) Enteric valve: presence or length of neck separating valve seat from rest of second pouch or proctodeum
(82) Enteric valve: presence or size of third (inner) lobe of valve seat
(83) Enteric valve: size of two outer lobes of valve seat
(84–87) Enteric valve: condition of cushions, retracted, produced, elongated, or extreme, for four independent positions

(88–91) Enteric valve main armature, scale or spine development (reticulated scaly, minute, small, pronounced, very elongated)
(92–95) Enteric valve main armature, spine numbers (0–10, 10+ to 20, 20+ to 30, 30+ to 40, no comparison if spines absent)
(96) Enteric valve: presence or size of spicules on wall between or beyond cushions
(97) Length of mixed segment of worker gut, relative to position of Malpighian knot
(98) Worker: colour of head capsule
(99) Worker: colour of head capsule pilosity

The CLASP programme provides for the computation of a matrix of coefficients of similarity between all the species, such that, as described by Sheals (1964):

$$S_{ij} = \frac{S_1 + S_2 + S_3 \ldots . S_k}{K} \tag{1}$$

where i and j refer to the OTU's being compared (in this case, species) and S_1, $S_2 \ldots . S_k$ are the similarities between them for each of the characters used, to the total K of characters for which comparisons are made. For qualitative characters S is scored on a match/mismatch basis, for a match $S = 1$ and a mismatch, $S = 0$. Similarity for quantitative characters is calculated by:

$$S_{ij} = 1 - \frac{|x_i - x_j|}{r} \tag{2}$$

where x_i, x_j are the ranked or continuous measurements, and r is the total range of the character in all of the taxa. The similarity coefficient S_{ij} between any two species thus rates a value between 0 and 1, but is presented as a percentage which is referred to as the *phenon* or *phenetic* level, or level of similarity. By the CLASP programme the matrix of similarity coefficients was first examined using the method of single-linkage cluster analysis. Every member of a group of species is similar to some other member at a phenetic level greater than L but similar to all non-members at phenetic levels less than or equal to L. L was first set to maximum (100%) phenon level and progressively decreased until all groups coalesced when sorting was terminated. A related form of clustering, median sorting, gave slightly different results as might be expected. Here after the selection of the first pair, the nearest neighbours of the mid point between them is taken rather than either member of the pair as in single linkage clustering. This to some extent reduces the likelihood of producing long chain clusters and seems intuitively more acceptable in considering relationships with more than one member when adding a new OTU to a cluster.

An alternative method of seeking structure in the similarity matrix is that named by Gower (1966), Principal Co-ordinates analysis. The matrix is first transformed by subtraction of row and column mean values from each corresponding matrix element added to the general mean of all elements, thus:

$$\alpha_{ij} = S_{ij} - \overline{S}_i - \overline{S}_j + \overline{S} \tag{3}$$

The Latent roots (eigenvalues) and vectors (eigenvectors) of the transformed matrix α are then found, scaling each vector so that the sum of squares of its elements equals its corresponding latent root. These vector elements provide the co-ordinates of the set of points representing OTU's (species) in relation to the orthogonal (un-correlated) principal axes of the entire set, whilst preserving unaltered their taxonomic distances, defined by $\sqrt{2(1 - S_{ij})}$. The effect of the transformation to α is to remove the tendency for the first vector of the un-transformed similarity matrix to have more or less constant elements which allow for the mean value of all the elements of **S**.

In the present study, as is usual, it was found that the relationships between the points could be adequately summarized in a few dimensions by restricting consideration to vectors corresponding to the largest roots of α. This involved deciding where the variation represented by the smaller latent roots became insignificant and could be taken as residual. The first root took up 19% of the trace of α, the second 9%, and the third, 6%, together comprising only 34% of the total sum of squares. The next three roots together brought this to 48% of the trace. To include further dimensions graphically would make presentation of the results unwieldy and more difficult to interpret. Although collectively the residual dimensions account for slightly more than half the total information content of the transformed matrix, individually their contributions are small. They are therefore ignored although it is realized that there must then be some distortion of the relationships represented by the taxonomic distances which become approximations.

The matrix of similarity coefficients calculated for the majority of species is shown in Text-figs 7, 7a. Each species included is given a serial number indicating its position in the systematic order of this paper. Some few species were discovered, and one or two synonymies decided after the completion of the similarity analysis. It did not seem worthwhile to re-run the analysis for so small a number of changes and a few species are therefore omitted or appear twice.

The three methods used to examine the similarity matrix gave results that agree in general but differ in detail. Many published exercises in numerical taxonomy have been undertaken to test either the conclusions of an existing conventional classification, or the numerical methods themselves by comparison with it. In the present investigation no conventional classification existed, and attempts to develop one without the analysis of similarity were unsuccessful. Nevertheless where the groupings suggested by the numerical results appeared wrong by conventional standards, they have been adjusted to conform to the latter. The generic classification presented here therefore results from a blend of numerical and conventional methods.

Certain genera stand out clearly, the most distinctive being *Ateuchotermes* (serial numbers 36–42 inclusive) which is separated in both types of cluster analysis (Text-figs 8 & 9) by a wide gap from its nearest neighbours. The species of this genus all unite above 88% phenon level apart from *A. tranquillus* (Silvestri) (42). At the time of the analysis this species was represented by incomplete material and many test comparisons could not be made. Although separated by the cluster analyses, it was placed close to its congeners in several dimensions of the principal co-ordinates

7

		58	60	59	55	49	45	50	47	48	51	15	6	31	53	52	4	5	1	54	46	17	3
cuniculator	58	----																					
scapheutes	60	80.4	----																				
choanensis	59	79.2	71.5	----																			
polyscolus	55	64.4	67.5	75.4	----																		
cnaphorus	49	65.7	65.8	72.0	92.0	----																	
disluctans	45	72.3	70.3	76.7	82.8	83.0	----																
disluctans	50	73.9	70.8	78.8	79.8	83.4	91.6	----															
ateuchestes	47	73.8	73.2	80.0	79.1	77.7	89.2	91.9	----														
cicur	48	74.0	69.0	77.4	76.5	78.7	88.8	87.6	89.6	----													
hemerus	51	71.9	68.5	73.5	77.6	80.9	89.8	87.4	86.7	88.4	----												
quietus	15	71.4	67.3	78.5	76.8	78.8	83.6	83.5	85.6	88.9	82.7	----											
concilians	6	74.4	68.2	79.1	75.3	76.0	79.9	81.8	85.9	84.8	79.7	87.5	----										
epius	31	71.5	66.3	74.8	75.6	76.7	84.7	82.6	83.5	88.9	84.8	83.7	81.6	----									
improelatans	53	75.6	72.1	76.7	73.4	76.6	81.5	86.2	85.1	83.5	81.6	83.6	89.3	80.5	----								
improcinctus	52	74.7	70.0	75.9	78.8	77.2	83.9	81.7	82.3	80.1	79.3	80.0	82.2	78.6	82.4	----							
benignus	4	67.4	66.7	79.4	76.2	75.1	79.1	82.5	82.5	80.8	76.0	82.5	82.5	80.2	78.6	86.0	----						
comis	5	75.0	71.9	75.9	73.5	70.0	76.4	78.1	80.8	76.7	71.5	78.2	82.3	73.6	81.1	85.3	80.8	----					
praus	1	66.2	70.6	71.1	71.6	67.7	72.7	70.7	77.9	74.9	69.6	74.1	77.7	70.6	72.0	75.9	77.5	85.5	----				
nanus	54	61.6	66.8	71.6	82.2	78.3	77.8	75.3	81.4	75.5	72.5	76.2	74.3	74.4	71.8	76.9	75.1	75.7	77.1	----			
amachetus	46	68.6	73.9	73.4	79.1	76.8	82.9	80.6	83.2	79.9	77.2	77.8	79.6	80.9	84.1	80.7	78.4	79.8	78.3	81.9	----		
impedians	17	73.6	77.4	72.0	76.8	77.5	82.6	83.7	84.8	79.9	81.9	81.1	82.5	77.6	81.1	76.8	74.5	77.0	78.4	74.5	78.3	----	
amicus	3	72.2	73.3	72.2	71.2	71.1	77.3	73.9	78.1	77.8	72.0	82.4	79.8	73.9	76.7	75.0	73.1	78.1	77.4	71.5	78.1	79.9	----
eumenus	7	72.0	77.1	72.9	74.1	72.8	80.0	81.9	82.4	74.8	74.7	73.9	77.6	71.9	79.2	78.8	75.3	80.8	79.1	74.2	79.1	84.8	82.7
cnirotus	30	68.5	73.0	69.0	75.8	76.2	82.7	81.0	80.8	79.6	82.2	77.5	79.8	81.9	81.0	80.6	76.1	76.0	72.7	72.3	76.8	78.7	76.7
imbellis	32	67.6	67.4	67.4	71.6	74.6	80.9	77.5	77.9	80.0	81.8	81.6	81.1	83.5	80.3	79.5	75.8	72.1	70.6	67.8	72.0	76.3	77.1
tithasus	33	70.4	67.2	66.6	68.2	69.3	77.7	81.9	79.1	77.7	79.9	75.5	78.8	78.9	81.2	72.2	69.7	74.1	68.7	63.9	70.3	76.7	72.7
irrixosus	18	64.8	57.7	63.8	66.3	71.9	78.2	77.3	72.7	77.4	82.1	76.0	70.8	80.6	72.7	71.8	72.6	65.6	57.9	61.8	68.7	70.0	66.8
kilimandjaricus	26	57.5	50.6	61.9	70.0	76.0	67.3	70.2	68.1	73.4	72.9	71.8	69.7	71.8	70.8	61.3	67.2	61.4	58.9	68.3	64.4	65.1	62.1
trestus	28	49.7	41.7	53.1	62.1	68.6	61.9	63.2	60.8	65.5	65.7	66.2	63.5	67.2	66.3	58.1	60.6	55.7	48.3	64.8	61.0	54.5	55.3
kilimandjaricus	27	56.3	52.9	60.1	73.7	76.3	72.4	72.2	69.2	70.2	75.4	70.7	63.9	72.0	68.2	64.7	63.5	62.9	55.9	70.7	64.4	67.7	58.6
apocnetus	21	56.4	49.7	57.7	62.9	69.4	71.4	70.2	67.9	72.6	75.3	73.0	67.8	74.8	68.9	66.7	67.0	59.7	54.2	67.4	64.3	62.6	62.9
mitis	10	72.8	71.7	73.0	75.8	76.1	84.4	82.0	83.9	82.5	84.4	84.4	78.2	83.2	79.3	75.5	76.7	75.2	73.9	70.9	79.1	84.1	80.7
trevior	13	73.6	61.6	71.1	72.0	73.8	81.2	78.3	74.8	80.6	79.6	82.1	76.9	80.6	77.4	78.0	75.8	71.7	63.6	65.7	71.8	73.6	67.3
aganus	8	67.6	64.2	70.9	71.4	74.6	80.0	78.1	75.8	79.0	82.7	81.0	76.0	81.8	79.4	77.7	74.6	70.3	64.3	64.4	73.3	76.9	71.2
empodius	16	69.9	65.9	71.2	68.9	70.7	80.5	78.2	79.0	81.4	82.4	82.4	75.6	78.1	74.1	73.6	70.7	72.0	68.1	65.6	69.4	77.8	73.3
moretelae	19	72.0	62.3	71.4	65.3	67.3	74.9	76.9	79.5	78.1	79.5	78.5	78.9	76.6	75.2	67.7	70.1	73.3	73.3	63.4	67.2	77.0	73.6
mircus	11	66.3	63.1	72.1	66.9	70.1	72.8	76.8	74.6	75.5	78.9	77.9	73.3	73.2	78.7	67.4	69.6	68.9	63.2	61.6	72.1	73.2	73.0
ignavus	9	68.1	65.5	71.6	78.4	80.8	83.2	82.6	78.5	81.0	84.3	83.1	78.6	83.5	82.8	77.1	77.4	72.5	69.5	71.3	80.7	76.4	72.5
ctenopher	36	59.1	48.8	62.5	70.0	69.8	66.2	65.5	64.4	66.7	64.9	68.2	63.9	68.1	67.4	62.5	61.7	60.8	51.8	69.5	66.1	58.5	58.0
spinulatus	41	55.1	43.0	55.1	62.2	66.5	61.1	61.8	57.6	63.8	62.8	65.4	62.1	64.2	64.0	58.4	61.7	54.8	47.9	60.7	59.5	53.5	56.7
muricatus	37	57.4	44.2	58.5	65.8	66.6	63.9	63.4	59.6	67.4	62.5	68.9	63.0	65.7	66.0	59.2	59.0	57.2	48.5	62.4	62.0	56.7	59.4
pectinatus	38	53.8	52.4	53.2	65.0	67.4	62.1	61.9	59.8	60.2	62.3	65.1	58.7	60.6	64.0	54.9	55.3	56.4	53.9	66.0	65.4	61.3	60.4
rastratus	39	55.0	48.7	54.1	67.0	69.7	63.8	61.9	60.8	64.4	66.0	65.4	61.5	62.8	63.6	56.6	56.0	56.5	55.7	64.7	65.0	60.8	62.4
sentosus	40	57.3	52.9	56.4	69.1	69.9	63.3	66.3	65.6	62.7	66.0	65.7	61.9	62.5	63.7	54.8	55.5	58.0	56.5	69.3	64.2	66.2	59.9
echinocolon	43	60.2	55.5	56.9	69.6	70.9	69.8	67.1	69.0	68.9	70.5	69.7	66.0	70.0	67.7	64.9	61.6	62.6	59.4	70.4	67.2	63.7	66.6
aneristus	20	62.2	61.0	67.7	69.8	74.3	75.7	78.3	75.7	74.6	75.5	73.6	71.1	75.3	72.4	63.0	67.9	63.0	67.6	73.8	72.9	73.8	70.6
acholus	12	76.5	67.9	75.8	75.4	77.4	79.2	80.6	79.6	83.7	80.6	79.9	79.6	76.1	81.2	75.7	74.4	76.7	74.4	69.4	74.4	80.2	77.2
obstructus	14	63.5	62.9	69.5	75.9	75.8	77.0	77.7	78.7	80.6	76.7	76.8	78.0	78.4	75.6	77.3	79.6	74.2	74.1	72.7	77.9	74.4	69.2
oryctes	29	65.9	58.2	67.0	64.9	68.1	74.7	76.0	77.3	79.9	81.6	78.6	80.8	78.9	79.0	71.6	72.4	68.3	67.7	61.4	67.0	72.6	66.7
galenus	34	52.9	55.0	55.4	66.9	67.7	63.9	65.7	68.3	62.6	67.2	64.5	61.6	65.3	65.9	59.4	59.5	58.6	57.9	67.3	65.2	66.3	62.2
cavator	56	56.0	50.8	58.0	64.0	66.1	69.5	66.7	64.4	67.4	69.4	66.2	61.1	70.5	68.2	60.9	57.0	55.4	49.0	63.8	65.6	57.1	60.9
fossor	57	58.7	56.0	63.0	71.0	72.9	76.8	74.6	72.2	72.4	75.0	70.8	63.7	75.4	69.7	64.9	61.1	58.2	53.4	73.1	67.8	64.9	65.0
mansuetus	23	58.8	54.7	57.8	60.4	62.6	70.3	66.3	68.5	67.8	67.6	68.9	62.8	70.5	65.8	60.6	59.6	62.1	59.5	66.0	65.4	61.7	68.8
hilarus	22	57.3	56.4	61.4	66.1	69.6	72.0	70.8	72.1	71.5	74.5	71.7	68.1	77.3	71.3	68.5	67.8	63.9	63.1	70.2	69.5	67.8	66.6
pacatus	24	60.3	56.9	60.6	68.5	70.9	70.9	69.4	70.2	70.9	73.5	71.0	67.9	72.9	71.1	64.0	62.5	63.1	59.9	74.1	72.3	67.7	63.5
prosenus	25	51.8	49.5	52.7	63.1	66.1	68.8	64.2	62.2	63.3	70.1	65.3	58.7	64.3	63.5	58.9	55.4	53.5	51.7	61.5	66.1	61.0	62.1
phaeocephalus	2	53.7	56.7	62.8	72.1	71.1	65.3	64.9	68.7	70.2	68.7	71.5	66.8	70.4	67.1	66.9	70.4	65.1	64.3	76.7	70.8	65.9	67.1
coronatus	44	59.5	55.0	61.4	65.9	69.6	71.1	68.7	67.9	71.3	77.8	70.3	65.7	70.6	69.4	70.2	66.9	64.4	58.3	60.8	65.1	64.2	61.0
stolidus	35	58.1	61.8	64.2	74.0	71.4	69.6	70.0	72.3	74.4	67.5	70.3	71.6	71.6	69.3	73.2	75.7	71.4	72.2	76.4	70.4	68.2	66.1
tranquillus	42	58.3	46.5	56.2	59.6	63.3	66.7	61.5	57.9	63.9	70.1	67.4	60.5	70.0	64.3	59.1	54.6	48.1	37.5	53.4	55.6	56.1	49.6

FIGS 7 & 7a. Matrix of similarity co-efficients between species, similarities expressed as percentages.

7a

eumerus	7	----																					
chirotus	30	78.2	----																				
imbellis	32	72.2	92.4	----																			
tithasus	33	74.2	90.0	88.7	----																		
irrixosus	18	67.8	73.7	75.8	71.7	----																	
kilimandjaricus	26	59.9	63.2	65.6	64.8	76.4	----																
trestus	28	52.7	57.2	61.2	56.9	76.0	88.0	----															
kilimandjaricus	27	60.5	67.3	66.6	66.4	74.5	86.8	83.4	----														
apocnetus	21	58.3	66.0	72.7	65.3	82.2	81.0	81.5	78.9	----													
mitis	10	76.5	80.7	82.0	80.9	79.0	71.0	61.1	73.6	71.1	----												
brevior	13	67.4	72.4	75.6	71.8	76.8	69.6	67.7	75.7	73.3	77.6	----											
aganus	8	66.7	77.9	81.3	76.1	79.7	72.0	68.9	79.6	77.6	84.5	83.8	----										
empodius	16	69.6	75.7	76.4	75.3	78.3	71.9	63.5	73.5	72.1	84.2	76.9	84.6	----									
moretelae	19	71.9	72.0	74.8	77.9	74.9	75.6	65.8	70.3	71.0	82.0	73.1	77.6	85.2	----								
murcus	11	69.4	71.0	71.8	72.8	80.2	70.6	67.3	72.0	68.9	80.2	71.8	81.7	81.7	78.4	----							
ignavus	9	74.8	80.6	80.9	78.7	81.0	75.0	71.2	75.1	71.4	82.4	82.5	82.7	77.9	76.0	82.4	----						
ctenopher	36	55.4	62.5	60.0	60.9	61.9	73.4	73.9	78.2	63.8	66.6	68.9	65.4	63.1	59.2	62.1	70.7	----					
spinulatus	41	48.8	56.9	61.4	59.9	67.3	77.0	79.1	75.9	72.5	66.3	66.3	67.1	64.4	59.7	65.4	66.5	85.5	----				
muricatus	37	51.4	56.8	59.3	59.3	64.5	77.3	77.2	79.2	68.7	67.0	67.9	68.4	66.4	59.9	67.4	68.9	88.2	91.8	----			
pectinatus	38	56.1	57.9	58.6	60.2	62.1	76.4	76.0	77.5	65.0	68.1	61.2	64.3	63.1	61.4	67.6	71.5	83.4	86.8	88.6	----		
rastratus	39	55.2	60.0	61.7	60.5	63.4	78.3	75.3	77.5	66.6	69.5	62.2	65.7	65.3	63.6	67.0	69.2	82.2	87.8	88.6	91.0	----	
sentosus	40	60.5	60.3	57.7	63.5	58.9	74.9	71.0	76.5	60.3	67.4	60.6	59.7	63.9	65.0	63.7	70.5	86.1	81.0	83.2	90.4	86.5	----
echinocolon	43	60.9	67.8	69.9	68.1	65.1	79.4	77.9	80.6	74.1	72.3	66.6	70.9	68.0	71.3	63.6	72.5	76.9	76.0	76.8	81.1	79.8	78.1
aneristus	20	71.3	68.4	69.1	72.1	69.0	80.3	69.4	72.2	74.4	74.5	67.0	69.0	73.9	77.5	72.8	77.4	65.6	66.4	67.4	72.1	70.3	73.4
acholus	12	75.8	76.0	74.4	75.6	69.6	69.1	59.8	69.7	64.7	79.5	74.7	75.5	78.2	75.7	76.6	77.7	69.7	64.4	68.6	65.9	68.2	68.6
obstructus	14	70.6	72.7	73.0	69.0	67.0	69.0	59.8	65.6	65.5	73.6	73.0	71.1	70.0	68.8	66.3	76.3	59.8	58.2	59.4	58.3	63.3	60.8
cryctes	29	65.4	71.9	78.8	79.2	75.5	72.1	66.6	69.2	74.8	78.6	78.7	78.6	76.4	81.8	75.7	77.4	58.8	65.0	61.9	59.3	61.0	59.2
galenus	34	63.3	68.9	67.8	69.7	56.3	67.3	66.4	72.7	63.0	72.5	57.4	65.7	62.3	62.5	62.6	65.5	73.3	73.9	72.4	78.2	78.1	78.8
cavator	56	55.2	69.9	71.3	71.1	70.6	69.2	71.0	70.9	74.1	67.4	65.7	71.6	65.6	61.7	69.0	74.4	70.3	71.4	72.0	72.5	72.2	65.5
fossor	57	62.8	78.4	75.6	75.7	71.6	71.5	69.5	76.0	72.8	72.3	67.0	73.5	70.7	65.7	68.1	75.6	72.7	69.0	71.5	69.8	71.1	69.8
mansuetus	23	61.9	67.7	70.7	68.7	66.5	66.6	66.9	67.8	73.3	72.2	65.0	70.2	68.4	70.2	67.6	72.0	63.1	63.7	64.4	68.3	66.8	62.2
hilarus	22	60.9	71.9	75.4	70.1	67.7	71.7	65.1	72.8	75.7	76.3	66.6	75.0	69.3	69.5	70.1	72.8	64.8	63.6	63.2	62.2	64.6	59.9
pacatus	24	61.3	69.0	67.1	68.2	68.2	75.2	69.9	76.3	70.5	75.1	67.8	71.6	71.0	70.7	69.2	75.1	72.3	68.2	68.9	70.7	72.2	70.2
prosenus	25	54.6	62.8	66.6	63.9	72.3	67.1	66.7	68.5	72.5	70.2	62.1	70.4	68.8	63.1	71.1	69.9	61.5	65.5	63.8	67.0	71.3	63.3
phaeocephalus	2	59.4	66.2	64.4	60.2	61.1	69.0	66.0	71.2	66.0	66.4	62.6	66.0	61.6	59.7	66.5	70.6	69.1	60.6	63.4	62.2	62.6	65.7
coronatus	44	59.0	65.9	69.8	63.9	68.8	68.6	67.0	73.0	66.9	71.1	71.1	74.6	71.1	65.1	68.1	70.9	67.9	70.2	68.3	66.7	68.8	64.4
stolidus	35	66.8	73.3	70.6	68.8	55.4	67.2	59.5	65.8	60.7	66.8	61.1	62.5	64.3	63.4	57.6	67.0	68.0	64.3	66.8	65.2	67.5	67.5
tranquillus	42	44.5	60.1	65.6	58.3	78.2	69.2	75.7	75.7	77.4	66.2	71.0	76.5	71.7	60.0	71.2	69.8	68.0	76.2	76.1	68.0	67.5	60.0
		7	30	32	33	18	26	28	27	21	10	13	8	16	19	11	9	36	41	37	38	39	40

echinocolon	43	----															
aneristus	20	75.0	----														
acholus	12	69.1	73.4	----													
obstructus	14	65.0	70.1	76.3	----												
cryctes	29	68.2	70.3	74.4	72.1	----											
galenus	34	77.4	67.2	64.7	60.5	61.1	----										
cavator	56	74.3	71.9	64.3	56.9	62.7	69.1	----									
fossor	57	75.5	75.8	65.8	60.8	63.1	72.2	84.3	----								
mansuetus	23	78.4	75.7	66.9	67.2	64.6	65.1	79.2	76.2	----							
hilarus	22	72.9	75.8	71.0	77.0	70.5	68.9	68.8	72.2	81.0	----						
pacatus	24	76.5	78.5	70.6	73.5	65.3	67.7	73.3	76.3	80.9	83.5	----					
prosenus	25	68.5	66.6	61.4	68.6	65.2	60.8	69.3	68.5	75.0	74.6	77.5	----				
phaeocephalus	2	67.5	66.5	69.3	69.7	62.9	63.8	60.2	68.2	60.4	72.9	70.6	61.2	----			
coronatus	44	66.6	59.8	68.5	74.8	70.8	68.0	55.2	61.2	64.7	73.4	69.9	71.1	63.4	----		
stolidus	35	70.6	72.7	73.3	73.5	61.0	70.6	62.4	68.5	61.2	70.4	69.0	54.5	74.1	58.5	----	
tranquillus	42	61.0	58.3	55.8	54.8	65.5	57.2	75.1	74.0	64.9	68.0	66.5	71.4	56.1	70.8	46.1	----
		43	20	12	14	29	34	56	57	23	22	24	25	2	44	35	42

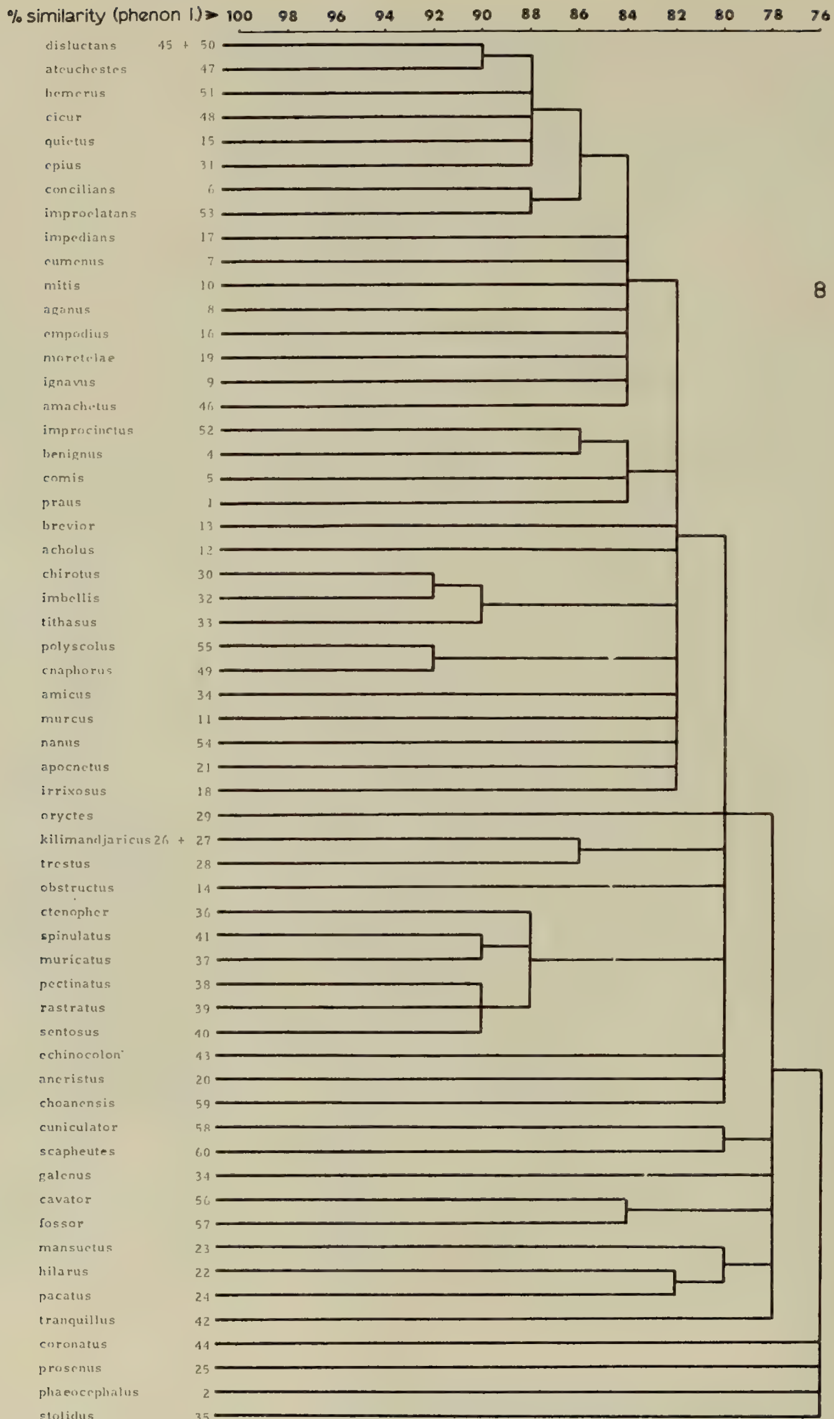


FIG. 8. Dendrogram showing phenetic relationships between species as indicated by single linkage cluster analysis.

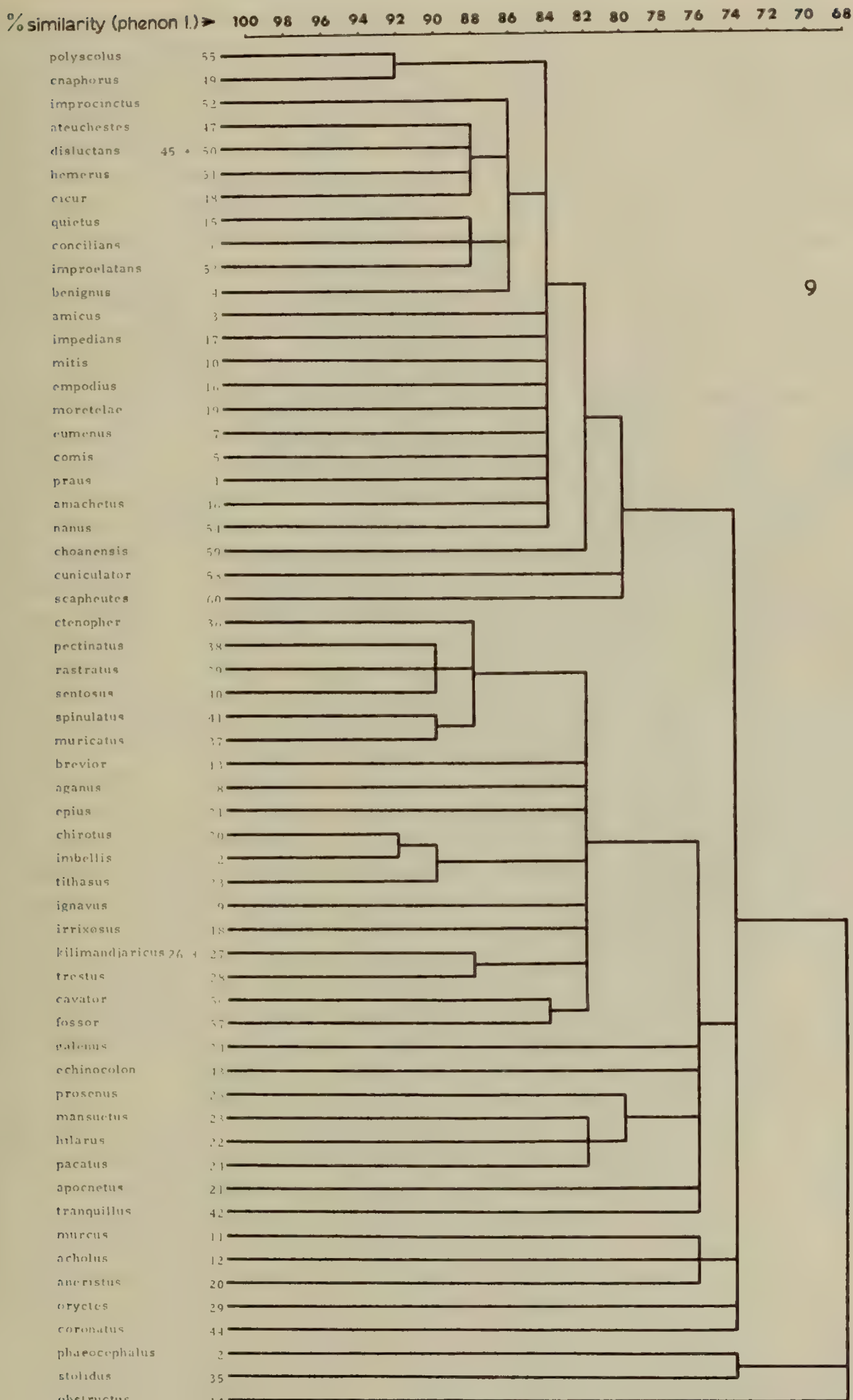


FIG. 9. Dendrogram showing phenetic relationships between species as indicated by median sorting.

analysis. Further material received later confirmed its membership of the genus. The position of *Ateuchotermes* is shown clearly in the three-dimensional graphs of the first six eigenvectors. All these were plotted as part of computer output, but the diagrams have been modified in various ways to enhance their visual impact. Vectors 1, 2 and 3 have been converted into a 'glass box' diagram (Text-fig. 10) with floors dividing the total range of vector 3 into four equal parts. Co-ordinates of vectors 1 and 2 are drawn in full on the last floor through which the stem of vector 3 passes before reaching the species point. From the last floor to the species point the stem is twice its lower thickness. Where the terminal part of a stem is hidden by the floor above it is drawn broken. The vector 2 shadow lines on the base plate help in spotting the origin of points arising from clumps on vectors 1 and 2. This type of diagram has been used effectively with fewer points in smaller analyses but is too complicated to be of much help in interpreting these results. Accordingly all other three-dimensional graphs have only been modified by adding their basal co-ordinates, which reverse direction about the zero value of each vector. The rest of the first six vectors have been plotted in the combinations 4, 5, 6; 1, 3, 5 and 2, 4, 6 in Text-figs 11, 12 & 13. This enables the relationships of species and genera to be visualized more clearly than would be possible in a single diagram. In the graph of vectors 1, 3, 5 the monotypic genera have been marked distinctively. Some species show up as more distinct from the main cloud of points in certain dimensions rather than others. An example is the monotypic genus *Adynatotermes* (19) which is distinct on vector diagrams 1, 3, 5 and 4, 5, 6. In other dimensions it is not far from the large loose group of points representing the genera *Astalotermes* and *Anenteotermes*, and it falls among them in both cluster analyses.

The distribution of points along the principal axes of the multivariate cloud represented by vectors 2, 4 and 6 seems to be more even than on vectors 1, 3 and 5, the latter combination producing the clearest indication of clustering. It is therefore used, with appropriate markings, in the introductory sections to successive genera to indicate the positions of their respective clusters and to compare them with those derived from the canonical variates analysis. In an analysis of the 'Q'-type such as the principal co-ordinates, the contributions of individual characters to the total variance represented by successive latent roots cannot readily be assessed as they can in an 'R'-type study. Thus the reasons for differences of dispersion along the principal axes remain unknown.

Other genera that stand out clearly in the cluster analyses are *Alyscotermes* (26–28) which is separated by a phenon gap of 6% from its relatives, and *Aderitotermes* (56–57). Three species of *Acholotermes* (30, 32, 33) come out together in both cluster analyses, but the fourth species (31) is variously separated from them. This is because its nearest neighbours are members of *Anenteotermes* as can be seen from the vector diagrams. It is located on the same side of the larger cluster as the other members of its genus, and a conventional decision places it differently from the numerical methods. It has a short mixed segment like the other *Acholotermes*, not a long one like *Anenteotermes*, and is possibly a transitional species.

In the single linkage clustering three species of *Astratotermes* (22–24) form a group, and median sorting adds a fourth (25), while a fifth (21) comes in at the next general

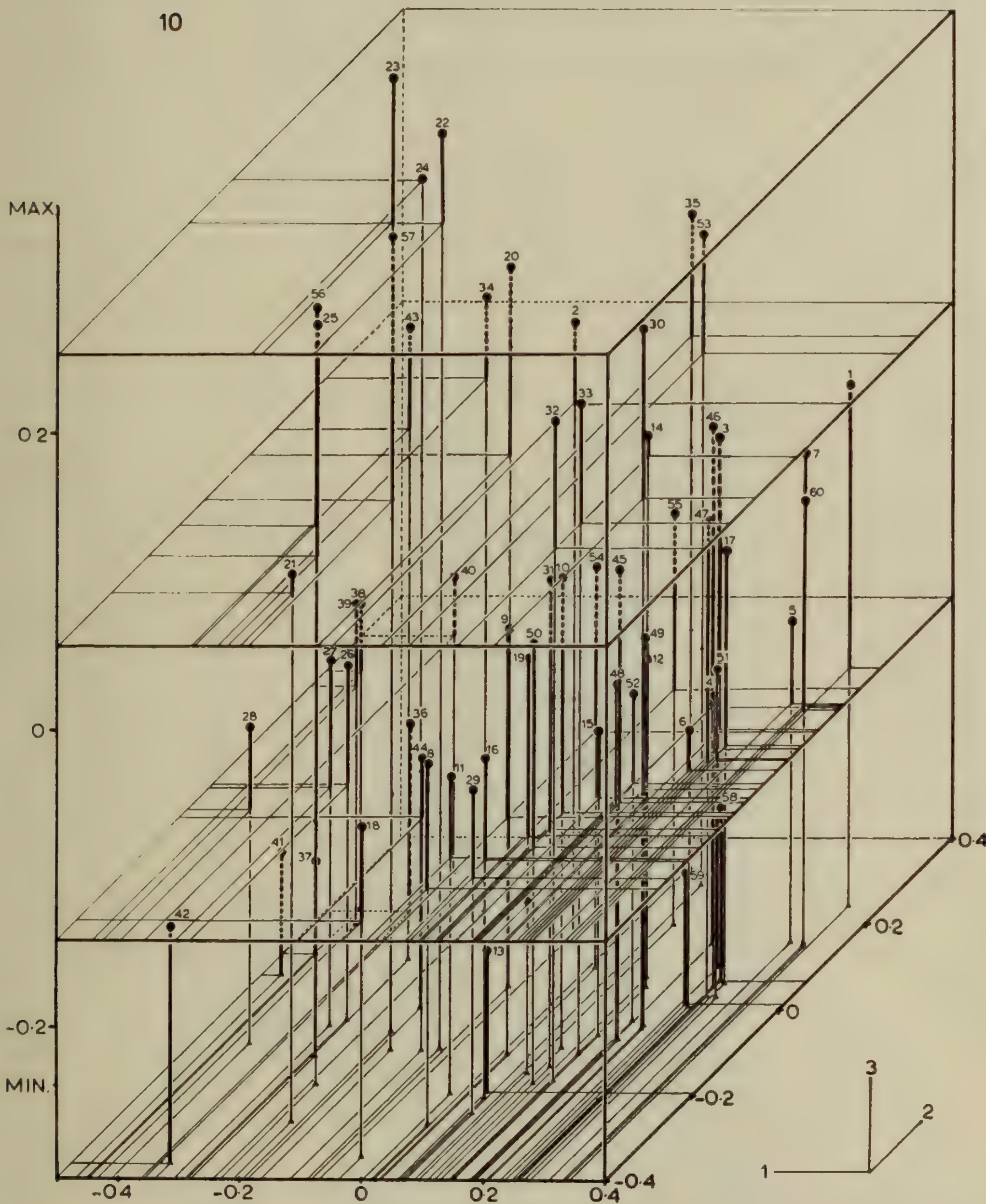


FIG. 10. Three-dimensional graph of principal co-ordinates analysis-plot of eigenvectors corresponding to latent roots 1, 2 & 3 in a 'glass box' diagram. Species-points are numbered to correspond with Text-figs 7–9.

additive level. The last species (20) is not clearly linked with the rest by cluster analysis but on vector diagrams 1, 2, 3 and 1, 3, 5 stands nearby. Its separation and that of (21) arises from their positions at lower levels shown on vector diagrams 4, 5, 6 and 2, 4, 6.

The genera *Adaiphrotermes*, *Anenteotermes* and *Astalotermes* were not very clearly

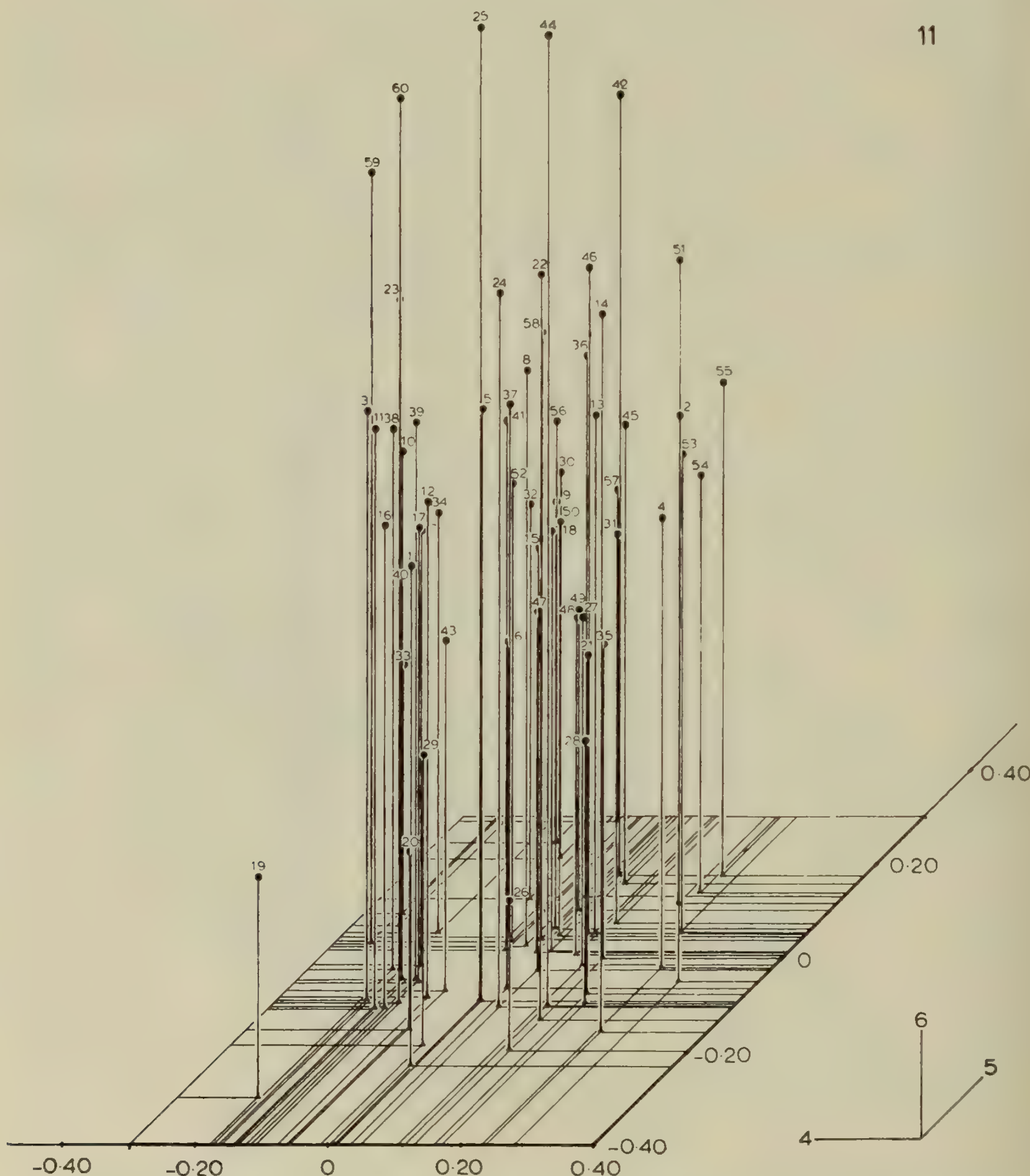


FIG. 11. Three-dimensional graph of principal co-ordinates analysis-plot of eigenvectors corresponding to latent roots 4, 5 & 6.

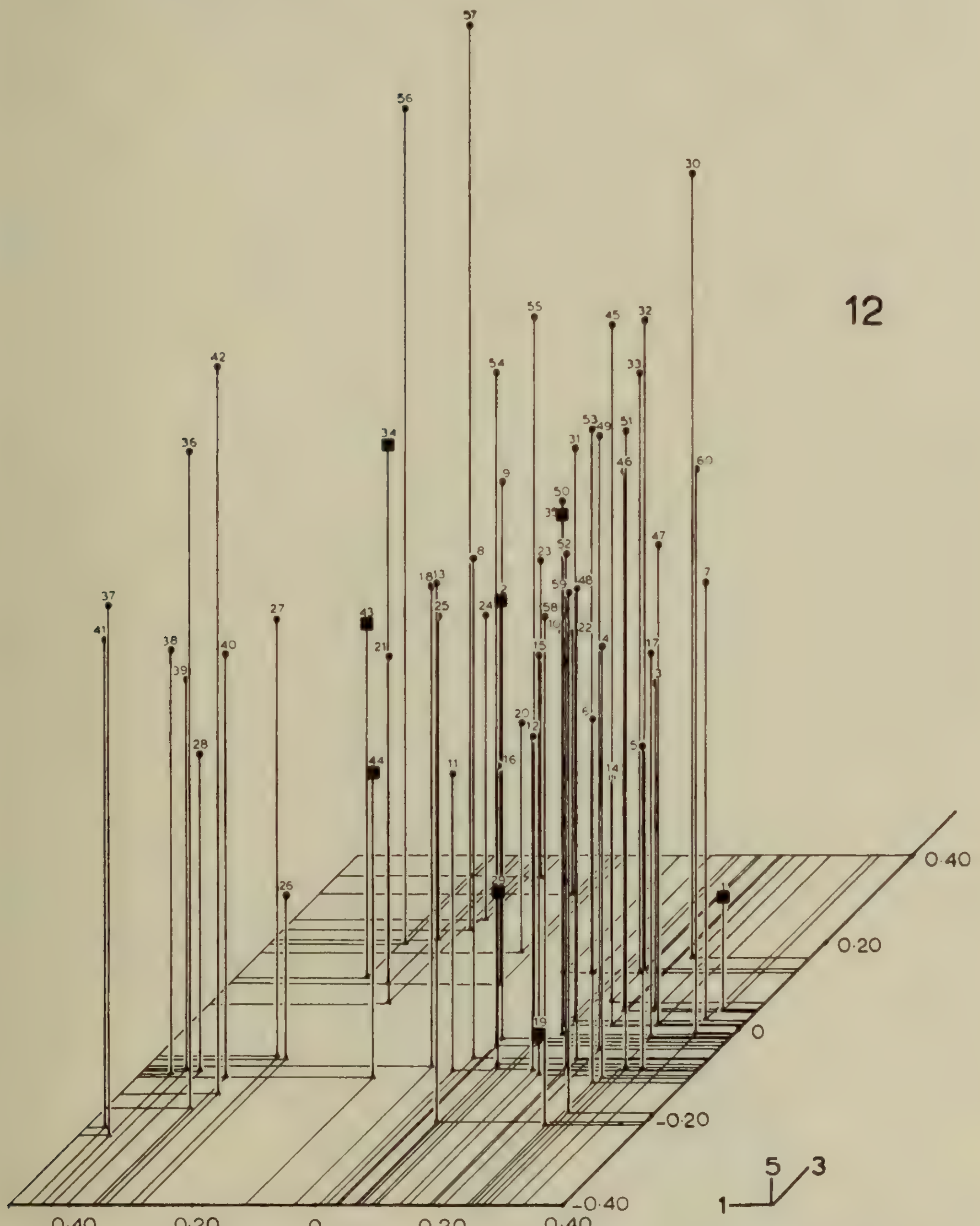


FIG. 12. Three-dimensional graph of principal co-ordinates analysis-plot of eigenvectors corresponding to latent roots 1, 3 & 5. Monotypic genera marked with large black squares.

distinguished by any numerical methods and the reason for this is obvious from the vector diagrams. As already mentioned they form a rather large loose cluster with no clear divisions. *Astalotermes* (3–18) occupies the 'lower' half of the cluster in the graphs of vectors 1, 2, 3 and 1, 3, 5 with little mingling, reflecting the largely

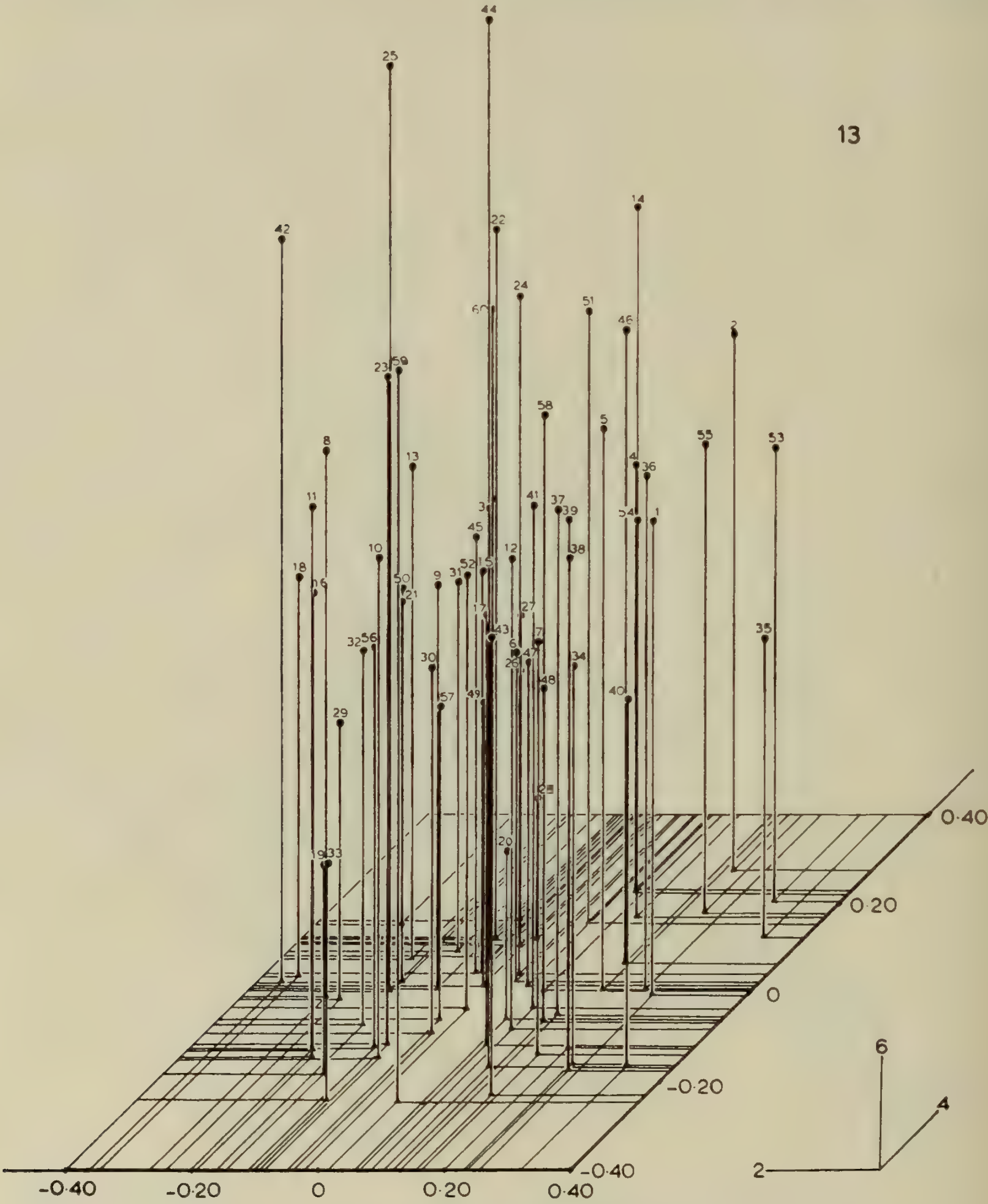


FIG. 13. Three-dimensional graph of principal co-ordinates analysis-plot of eigenvectors corresponding to latent roots 2, 4 & 6.

negative or low positive values of their corresponding elements of vectors 3 and 5. *Anenteotermes* (45–55) occupies the 'upper' half of the cluster having largely positive or low negative values in these vectors. *Adaiphrotermes* forms a line of three points (58–60) to one side. The nearest neighbours of some species in each genus are in the adjoining genera, and this is accentuated by the close intermingling of the species of all three that occurs in other dimensions all of which contribute to the taxonomic similarities on which the cluster analyses are based. In these three genera which are generally similar, the intestinal characters clearly separate them on a conventional basis. *Astalotermes* has virtually no mesenteric overlap with the proctodeum, or mixed segment. In *Anenteotermes* there is a long mixed segment, also present in *Adaiphrotermes*, but in the latter the mesenteron is dilated at its posterior end and the fore tibia has only two apical spurs. The relationships of the genera are discussed in more detail in the section on phylogeny.

Multivariate analyses of measurements

The shortage of other characters has led taxonomists to make increasing use of measurements in studying termites. However, this has developed very largely on a trial and error basis and a large number of differing measurements and ratios (indices) have been employed. Roonwal (1964) noted that 66 measurements and 34 indices had been published and suggested a further 22 and 19 respectively bringing the totals to 88 measurements and 53 ratios. He recognized that such numbers were impractical and advocated a selection of the 'more useful and sensitive characters' numbering 32 measurements and 18 indices 'for general use'. The method of assessing sensitivity was not indicated. There has been some published discussion on the numbers of individuals of any species or colony series that should be measured to obtain a representative sample for statistical purposes. Bouillon (1966) concluded that 6–10 specimens were sufficient. Variation within colonies of the soldierless termites was soon found to be slight, about 5% being the maximum range for either sex or caste. In these small termites accurate measurements of small features such as mandibular teeth are difficult to take. It was concluded from preliminary tests with common, well represented species, that for the purposes of the multivariate analyses it was adequate to measure one or two specimens of each caste from each colony.

One of the first applications of multivariate analysis to a taxonomic problem was made by Stroud (1953) using the complete centroid method of factor analysis (a close approximation to principal component analysis) to sets of measurements of the imago and soldier caste of *Kalotermes* species. Since then these methods have been applied in many other plant and animal groups, but not in termite systematics.

The purposes of principal component analysis used in taxonomic problems may be summarized as the extraction from a large body of primary data the smallest number of meaningful dimensions; to interpret these where possible in terms of recognizable characteristics, and to derive from their objective weightings a set of taxonomic indices giving the best discrimination of individuals. The clustering of individuals into groups can be examined, and misplaced specimens recognized.

Canonical variate analysis has similar purposes to principal component analysis, except that it requires all individuals to be assigned to taxa and each taxon to be represented by more than one specimen. The weighting of variables is then directed to those providing the best discrimination between the taxa.

Both types of analysis treat individuals or individual taxa as points in a hyperspace, their positions defined by the numerical values of all their measured variables. Both seek new sets of orthogonal (uncorrelated) co-ordinates corresponding to successive axes of maximum variation of the scatter-cloud of points. The difference between the two is that where principal component analysis is concerned with the dispersion of individuals, canonical variate analyses measures the dispersion of the ends of the mean vectors of the taxa. Thus the characters weighted by the two analyses will not necessarily be the same. However, there is likely to be a tendency for this to happen in a large body of data. Both analyses call for the extraction of the latent roots and vectors of a matrix. The vectors provide weighting coefficients by which the transformation of the variables (characters) to the new set of co-ordinates is achieved. In principal components either the variance-covariance matrix or the correlation matrix is used. In the latter case the variables are standardized, being expressed in standard deviation units with a variance of 1. This is the commoner procedure, and was employed here. In canonical variate analysis the 'between-taxa' and 'within-taxa' dispersion matrices are together used to compute a further matrix, of which the latent vectors give the required multiple discriminant functions.

The total number of latent roots and vectors produced is the same as the number of original variables. The size of successive latent roots indicates the proportion of the total variance of the matrix taken up by each of the new co-ordinates in turn. The number of roots, and hence the corresponding vectors, considered significant depends on their relative size. One convention recommended by Kaiser (1960) and Harman (1960) is to disregard roots smaller than 1·0. However, when using the analyses mainly for descriptive purposes, as here, it seemed more appropriate to examine the elements of the vectors to determine the point at which large weighting coefficients cease to be attached to new characters. This would suggest that little further significant information was being extracted.

It would also have been possible to carry out a principal component ('R'-type) analysis of a correlation matrix based on the coded character data described earlier. However, Gower (1966) pointed out that the 'Q'-type approach of principal co-ordinate analysis based on a similarity matrix is mathematically equivalent to the 'R'-type, but is computationally simpler and statistically more appropriate when many qualitative variates are included.

In order to arrive at an objective assessment of the taxonomic value of measurements to be used, several principal component and canonical variate (multiple discriminant) analyses were undertaken. More measurements of both imago and worker castes were made than were likely to be put to practical use, in the expectation that the analyses would pick out the most valuable. Some of those suggested by Roonwal were rejected because they are those of parts easily altered by distortion

due to drying, ageing, or feeding differences of specimens. Others were eliminated because they cannot be delimited by fixed points but depend upon the angle at which the specimen is held; others again are those of parts too often missing in all but freshly moulted specimens. The absence of the soldier reduced the numbers further. The input for the imago caste finally consisted of 25 measurements, and for the worker, 13. Some of these are listed in the previous section. The remainder were as follows: Imago: greatest diameter of compound eye, pronotum width, pronotum length, hind tibia length, width of postclypeus, length of antennal articles I, II, V and IX; Worker: pronotum width, length of hind tibia, and postclypeus width.

These measurements were recorded by means of an I.B.M. Port-a-punch on 40 alternate columns of special partially pre-punched 80 column-type cards, as microscope eyepiece graticule divisions. In this form they are already acceptable to some computer installations, but it was also easy to reproduce the data in the first 40 columns of standard cards by machine, and considerable savings of time in handling and preparation of input for computer processing resulted. Conversion to millimetre values, summarization of the data and calculation of complex ratios, as well as the more sophisticated techniques, were all able to proceed without the need for further transcription.

The measurements of the imago castes were subjected to two principal component analyses. The first used the raw data, and the second its logarithmic transformation. The purpose of the latter was partly to avoid any bias in the weighting of the characters arising from fairly large size differences among them (e.g. antennal articles or mandible measurements were often less than one-tenth head width or tibia length). In addition, it was desired to test the idea that the pattern of variation might be at least as well expressed by ratios as by linear functions of the variables. The weighting coefficients of the second analysis were almost identical with the first, suggesting that there was little likelihood of biased weightings arising from size differences. It also indicated the validity of interpreting the relationship between characters by complex ratios. This was particularly useful in the derivation of a set of taxonomic indices, since a positive character weighting could be interpreted by a multiplication and a negative weighting by division. The larger weighting coefficients of any vector tended to be rather similar in size. Because eigenvectors are scaled arbitrarily, it is the relative size of the elements that is important. Therefore in calculating taxonomic indices for practical use in keys, it was a sufficient rough approximation to use the raw measurements without the additional complication of weighting coefficients.

Since the two analyses of the imago were so nearly identical only the raw measurements were used for a principal component analysis of the worker caste. One further analysis of this type was undertaken in which the measurements of a single female imago and one worker from each nest-series were combined as representing a set of attributes of the colony. It was necessary to confine the choice of imago to one sex because there is a slight tendency for males to be smaller than females, and to mix them would have obscured the relationship between the variables. The purpose of this last analysis was to see whether it gave any clearer indication

of clustering and incidentally to find out whether any adaptive features of the same structures of one caste were expressed as dimensions of variation clearly independent of the other. In addition, by using only a selected part of the data, it provided a check on the validity of character weighting obtained from the other analyses.

In this combined analysis of the imago and worker characters the lowest correlations occurred, as expected, between those of different castes and present in only one of them. Imago antennal articles, for example, were weakly correlated with worker fore tibia width. Since these probably represent adaptations to totally

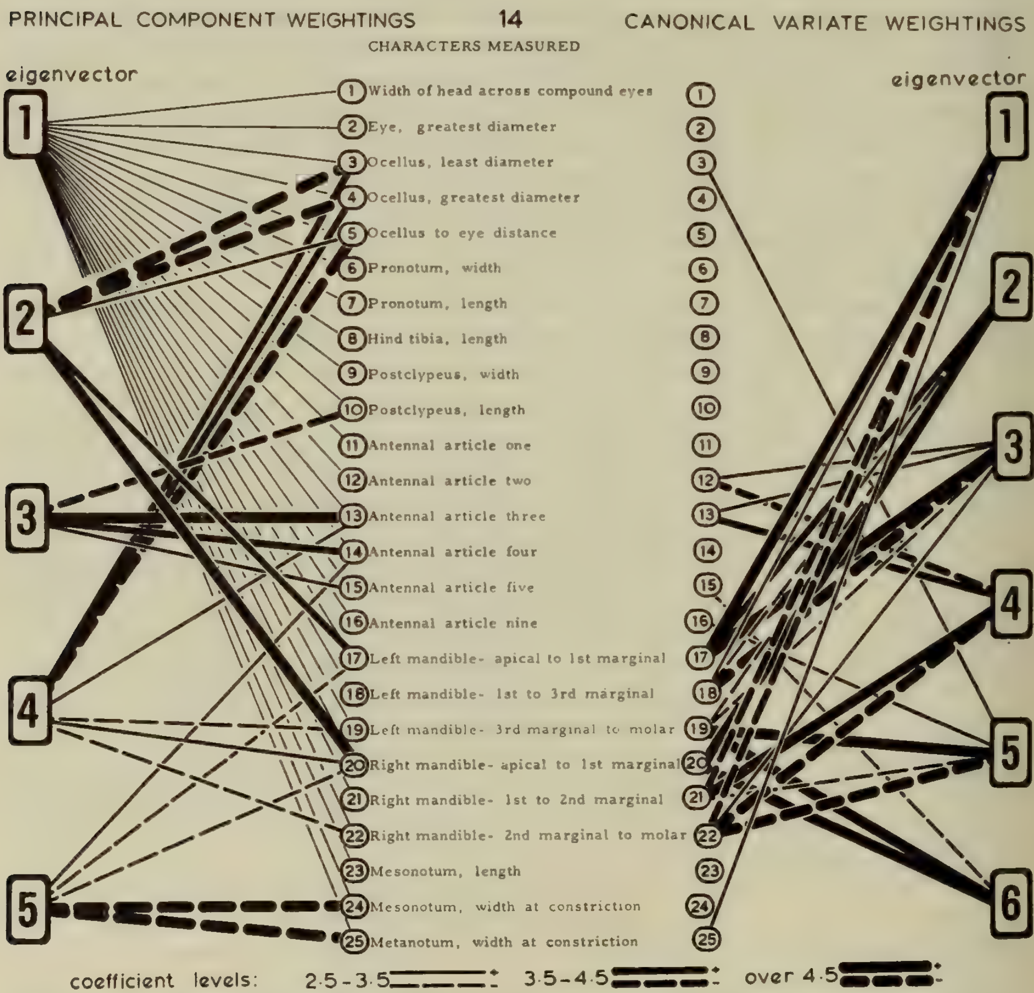


FIG. 14. Imago caste-weightings of measured characters obtained from two multivariate analyses, principal components and canonical variates. The weighting co-efficients of eigenvector 1 of the principal component analysis were all less than 2·5 and closely similar in value.

different aspects of behaviour and environment their variation is unlikely to be closely linked, except by a general size factor. However, the correlations between corresponding characters of imagos and workers were sometimes lower than might be expected on the assumption that they are adapted to the same functions. The inter-caste correlations, expressed as percentages, are tabulated for the common characters of imago and worker as follows:

Head width	94·15
Pronotum width	87·38
Hind tibia length	91·84
Postclypeus width	90·46
Postclypeus length	74·17
Left mandible, apical to first marginal tooth	92·23
Left mandible, first to third marginal	88·47
Left mandible, third marginal to molar	76·09
Right mandible, apical to fiist marginal	91·14
Right mandible, first to second marginal	87·15
Right mandible, second marginal to molar	80·18

This table would seem to show that while the lengths of apical teeth of the

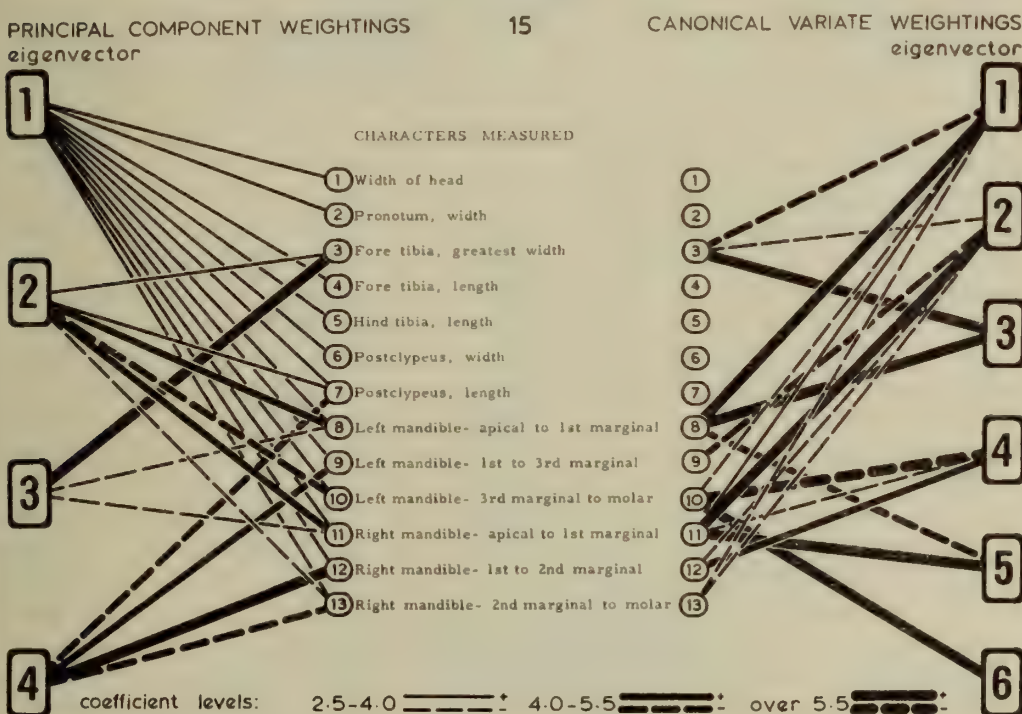


FIG. 15. Worker caste-weightings of measured characters obtained from two multivariate analyses as in 14. In the principal component analysis the weighting coefficient on character 3 in eigenvector 1 was about half the size of the rest.

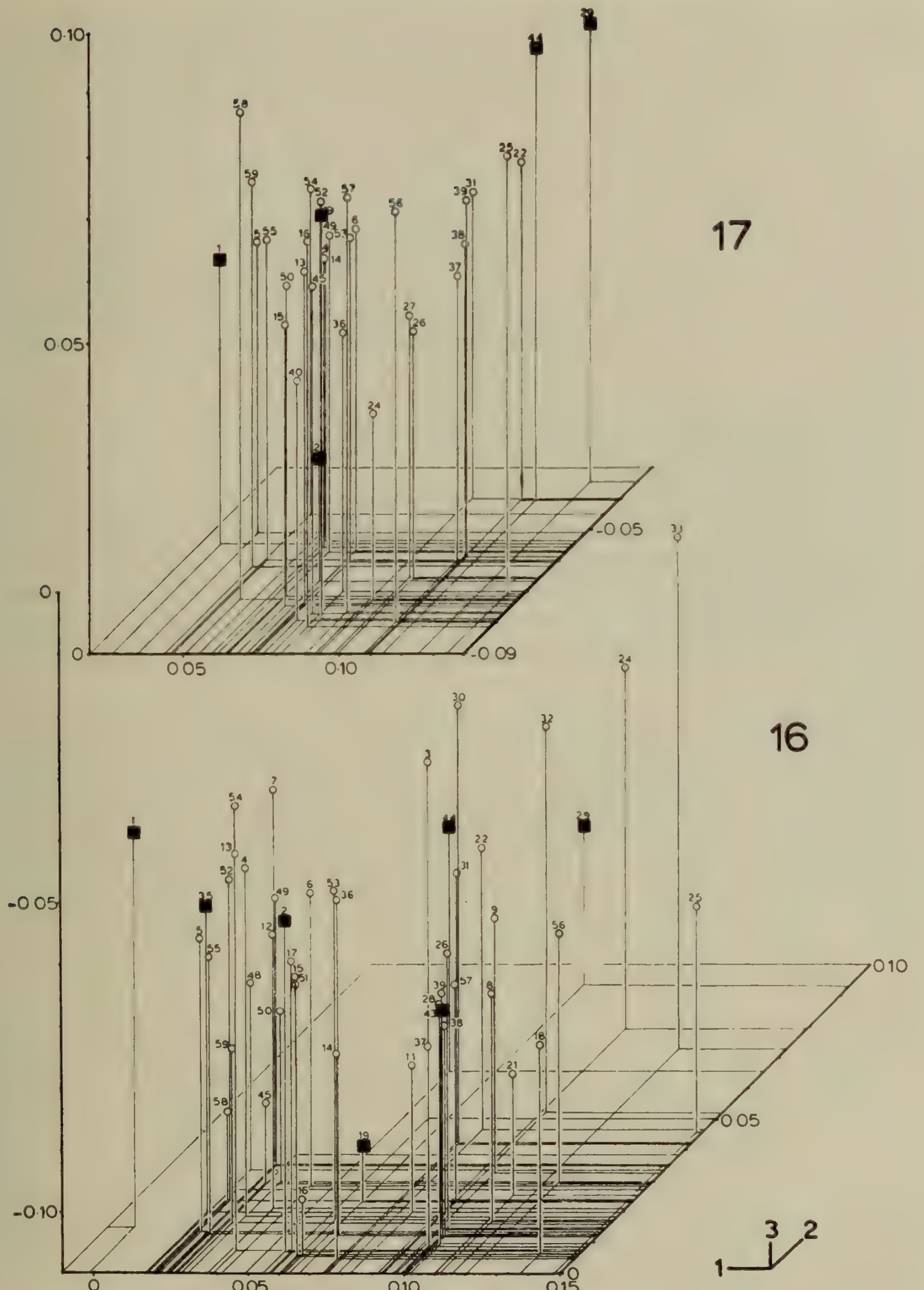
mandibles of both castes are closely correlated, there is a good deal of independent variation in the proportions of marginal and molar parts of the worker mandibles. These sections of the mandible are not merely more variable than those of the imago, but proportionately more variable than their own apical sections. It is not yet clear how to interpret this in terms of adaptation to feeding or other behaviour, and more detailed studies need to be made.

The length of the worker postclypeus is similarly less strongly correlated with that of the imago than might be expected. Since the postclypeus houses the cibarial dilator muscles it is probably associated with the pumping or manipulation of moistened soil particles. It is conceivable that this is associated in imagos with tunnelling to found a new colony and otherwise little used, whereas in the worker it must be used in a variety of ways throughout its life. The independent variation could be a response to different situations.

The independent dimensions of variation indicated by the correlation coefficients were also shown in the elements of the eigenvectors corresponding to the first five latent roots that together accounted for 89% of the trace of the correlation matrix. The first vector as usual consisted of largely similar elements, associated with a general size factor, and represented 76% of the variation. The second vector had its largest elements contrasting the apical teeth of the imago mandible with the molar measurements of workers. Other features given major importance by this vector were the worker apical teeth and the length of the imago postclypeus. The third and fourth vectors were mainly concerned with variation in characters only present in one caste or the other. It was not until the fifth vector that the small independent variation of the worker postclypeus received a weighting coefficient of any size, and here it was involved in a contrast with several characters of imago and worker mandibles. This vector corresponds to a latent root of less than 1·0 (0·7) representing only 1·8% of the variance. This brief account serves to show that the method may yield useful comparisons of homologous structures in different castes of social insects. The detailed figures of the analysis are not appropriate in this context, and the full data are retained for future reference at the BMNH.

The canonical variates analyses carried out separately on imago and worker castes demanded at least two representatives of each of the species included, and some consequently had to be left out. Instead of the 60 putative species represented in the foregoing analyses, the analysis of the imago covered 50, and that of the workers 34 species. Thus although the canonical variates gave some indication of the grouping of species into genera so far as this is shown by measurements they were necessarily incomplete. The larger weightings of these two analyses, although naturally with different numerical values, were attached to essentially the same set of characters as in the principal component analysis. This probably arose partly from the fact that many species were represented by small numbers of specimens and the dispersion of the ends of the mean vectors was thus closely related to that of the individuals. However, the combinations of character weightings in the eigenvectors differed slightly, suggesting differing emphasis on characters involved in clustering species and on those of greater value for generic discrimination.

The character weightings obtained from both principal component analyses and



FIGS 16 & 17. Three-dimensional graphs of canonical variates 1, 2 & 3. 16, Imago; 17, worker caste. Species-points numbered as in Text-figs 7–13, monotypic genera marked by solid squares.

canonical variate analyses are shown graphically for the imago and worker castes in Text-figs 14 & 15 respectively. These diagrams are intended to be self-explanatory and avoid the necessity for tables of figures. In the principal component analysis the weighting coefficients of the first eigenvector all tend to be similar in size, representing what in factor analysis is sometimes called a general factor, apparently related to the general size of the insect. All measurement characters will naturally contain a large element of closely correlated size variation and the first vector is often disregarded except to take one convenient measurement as a size indicator. In the present work the width of the head is used. In the worker diagram it is worth noting that character 3 carried a much lower weighting on the first vector, indicating an unusually large proportion of the variation independent of size. This reflects its importance as a taxonomic character and its interest as an adaptive feature.

The correlation matrices, the numerical values of the vectors, the component scores, and the canonical variates are not published in full to save space. Two-dimensional graphs of principal component scores are shown under the headings of individual genera where they are of interest in separating pairs of closely related species or indicating misidentifications. The first three canonical variates of imago and worker castes are used in the introduction of each genus to illustrate the clustering of species based on numerical characters for comparison with that of the principal co-ordinates. The positions of the species of each genus are shown by solid spots instead of circles. The monotypic genera are shown together in Text-figs 16 & 17.

Text-figures

The termites have all been drawn with the aid of a camera lucida, from ethanol-preserved specimens immersed in ethanol. Two scales are used, the larger being twice the smaller. All illustrations of entire head capsules are on the smaller scale and all mandibles on the larger. Parts of the intestines of the worker caste are on either scale according to their relative size but the scale of any particular part is not altered between species on one page of illustrations. The only exceptions to the above are illustrations of the entire gut, which are on a third, lower scale.

PHYLOGENY

The description here of numerous new species and genera throws the existing classification somewhat out of balance. Similar undescribed complexes exist in other zoogeographical regions, and will, when described, add to this difficulty. The previously described species included in this study have hitherto been placed in the genus *Anoplotermes* of the subfamily Amitermitinae. This subfamily has included a considerable variety of forms, and habits ranging from soil-feeding, through wood- and detritus-feeding to harvesting grasses and foliage. Ahmad (1950) recognized four evolutionary series based primarily on the dentition of the imago and worker mandibles within the subfamily. He regarded the group that included *Anoplotermes* and *Speculitermes* as the most primitive, and in his hypothetical phylogenetic tree showed it branching off near the base of the main stem. The remaining groups he regarded as more closely related to one another as side

branches at a higher level. Thus the most significant division of the subfamily separated off the mainly soil- or litter-feeding forms which are characterized by an segment. This also applies to the other 'genus' mentioned by these authors, namely those species of african '*Anoplotermes*' known to them. In the latter group the enteric valve was stated to be unarmed.

One further genus has been described in the subfamily that does not fit the two main groups as defined above. Deligne & Pasteels (1969) give details of the intestine of *Labidotermes*. There is no mixed segment in this genus and the malpighian tubules are attached to the midgut. The enteric valve armature has only a single large tooth at the anterior end of each cushion. The worker mandibles are similar to those of the *Anoplotermes-Speculitermes* group.
indentation of the incisor edge of the left mandible separating the third marginal tooth from the first plus second. Ahmad considered the right mandible to be more specialized in the curved posterior edge of the second marginal, on the grounds that the 'primitive' condition had a straight cutting edge. In this he was influenced by its appearance in most of the otherwise primitive wood-feeding groups of termites. It should be noted, however, that in the primitive cockroaches, *Polyphaga* and *Cryptocercus*, as well as most of the rest of this group, the right second marginal has a convex anterior and concave posterior margin. In first instars of *Archotermopsis* the same applies, the tooth becoming straighter in adults. It seems probable that this straightening of the right second marginal tooth is an adaptation to feeding on fibrous materials that require shearing. This is supported by the same tooth in the soldier caste of some wood-feeding primitive forms. When the expression of the gene complex controlling mandible development switches to the piercing soldier function, the tooth reverts to the cockroach form. Thus it would seem that where such a tooth occurs in otherwise primitive species it is itself a retention of an unspecialized condition.

When Noirot & Noirot-Timothée (1969) came to consider the intestinal structure of the Amitermitinae they found two basic patterns. One is found in the group of genera including *Anoplotermes*, *Speculitermes* and *Eurytermes*. The gizzard lacks armature, the mesenteron overlaps with the proctodeum to form a mixed segment, and the malpighian tubules are attached separately within the epithelium of the mesenteron. The enteric valve is unarmed. The other type occurs in the rest of the subfamily with one or two exceptions. The mixed segment is always well developed, often with the termination of the mesenteron to some extent inflated. The first segment of the proctodeum is commonly dilated and the malpighian tubules are inserted, usually in pairs, on the mesenteric-proctodeal junction. The gizzard carries typical armature. Associated with this group also are the genera *Protohamitermes*, *Prohamitermes*, *Globitermes* and *Synhamitermes*, which differ only in that the malpighian tubules are carried on evaginations at the junction of mesenteron and proctodeum rather than directly attached. Thus apart from *Protohamitermes* these authors agree with the basic division postulated by Ahmad. The mandibles of the latter genus are primitive in form and show some general resemblance of shape to the other main branch. Its gut is one of the more specialized, and clearly indicates that its affinities are with the *Amitermes* branch although

diverging from very near its base. One difficulty in accepting this position has been thought to be its lack of a soldier caste. However, 'soldierlessness' is an adaptive character that could develop several times over; considering the rarity of soldiers in a number of groups this is perhaps not a serious obstacle.

Noirot and Noirot-Timothée noted two exceptions to the above scheme. *Eburnitermes*, a monotypic genus described by Noirot (1966), was included by him in the Amitermitinae mainly on the basis of the similarity of the worker mandibles to *Eurytermes* and the soldier to those of the same group of genera. He pointed out the resemblance of the gut to that of the Apicotermitinae, particularly in the armature of the enteric valve and the short first segment of the proctodeum. The malpighian tubules are again attached some way up the midgut. There is no mixed segment. This also applies to the other 'genus' mentioned by these authors, namely those species of african '*Anoplotermes*' known to them. In the latter group the enteric valve was stated to be unarmed.

One further genus has been described in the subfamily that does not fit the two main groups as defined above. Deligne & Pasteels (1969) give details of the intestine of *Labidotermes*. There is no mixed segment in this genus and the malphigian tubules are attached to the midgut. The enteric valve armature has only a single large tooth at the anterior end of each cushion. The worker mandibles are similar to those of the *Anoplotermes-Speculitermes* group.

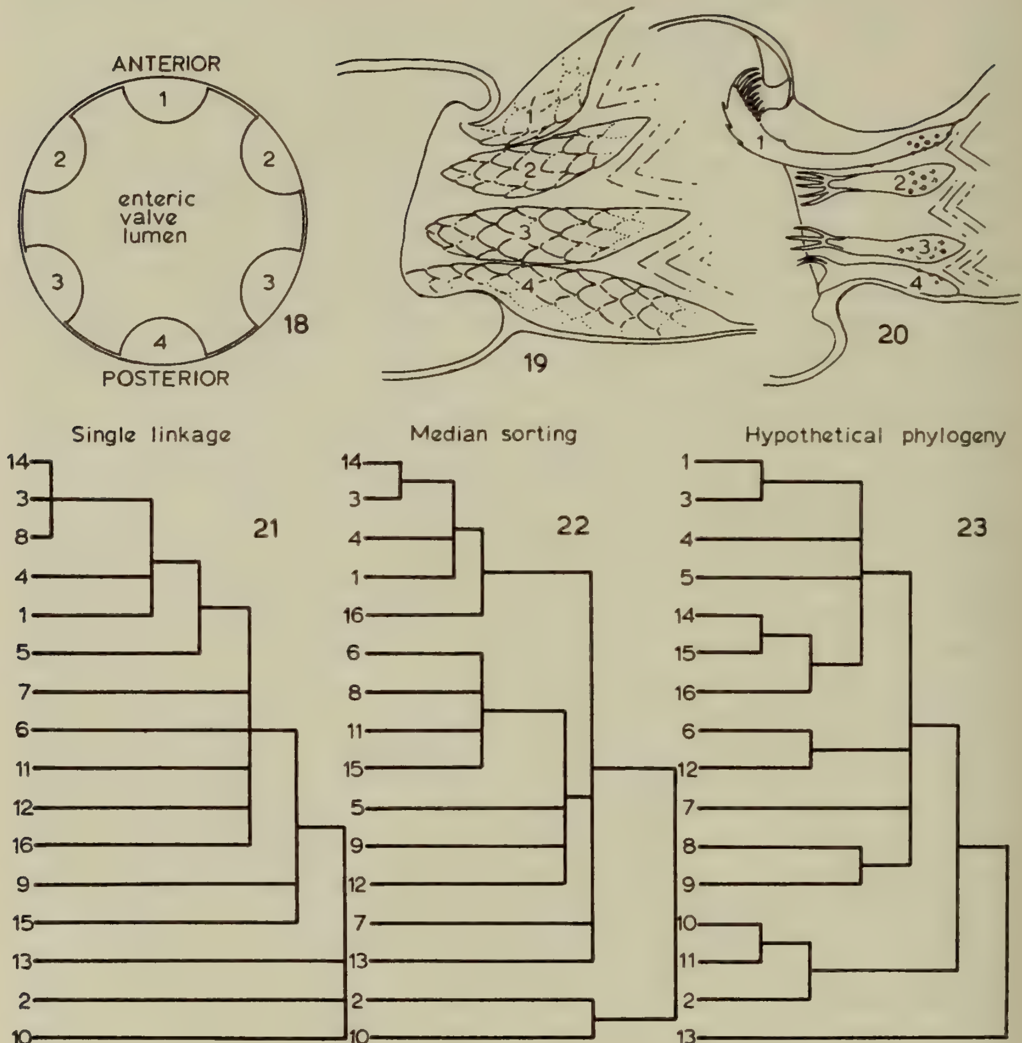
In a preceding section the layout of the gut of the african soldierless termites is described and an account given of its variations. Further details will be found in the introductory passages to genera and in species descriptions. The salient features are illustrated for all species. Within the group are found all stages in the development of the mesenteric overlap with the proctodeum from a simple transverse junction like those of *Eburnitermes* and *Labidotermes*, to elongated mixed segments with dilated ends. There are also all stages in the development of enteric valve armature from nothing at all to elaborate spines, hooks and sclerotizations everted through the valve opening. A similar though less extensive variety of forms has been seen in the Neotropical species of *Anoplotermes*. Thus the exceptions mentioned by Noirot and Noirot-Timothée to the two divisions of the Amitermitinae are not separable by any sharp division from the first type in which the malpighian tubules are attached to the wall of the midgut. In addition in all these forms the gizzard is feebly developed. The other important character is only readily appreciated by examination of the layout of the gut in situ. Once uncoiled, the relative positions of its parts are displaced. In the first type of Amitermitinae where a mixed segment is found the extension of the mesenteron is always around the inner curve of the coil of the gut on the same side as the insertion of the malpighian tubules.

In the second group of Amitermitinae the extended part of the mesenteron forming the mixed segment is always around the outside of the loop of the gut on the opposite side to the malpighian tubules where these are attached at the anterior end of the proctodeum. A number of possible exceptions have been examined, such as *Prohamitermes*. Here the mesenteron is effectively external, arising between the two outer malpighian tubules. In a more advanced *Eremotermes* species,

E. indicatus, it appears on the inside of a gut loop, but it is the one further forward, the proctodeum having elongated to a greater extent and pushed the very short mesenteron back. The mesenteric extension remains on the same side of the gut, and in *E. nanus* the mixed segment is of typical *Amitermes* form. In *Synhamitermes* the proctodeal overlap appears to have elongated more than that of the mesenteron, and has twisted across the latter. They remain morphologically on the same side as in less developed forms. These elongated mixed segments suggest that this structure may result more from a need to extend the proctodeum than the mesenteron.

Thus within the Amitermitinae as hitherto recognized there are two morphologically quite distinct lines. A parallel development of the mixed segment has taken place on opposite sides of the gut, and there is a radically different attachment of the malpighian tubules. It is therefore relevant to enquire whether the two lines resemble other subfamilies of Termitidae more than each other. In the Termitinae the pattern of the gut is essentially the same as in the second type of Amitermitinae. Minor modifications are found but they appear to be relatively small divergences from the same basic stock. The similarity of the most primitive forms of the first group of Amitermitinae to the Apicotermitinae has already been indicated, and it has been pointed out that numerous intermediates between them and the more specialized forms with a long mixed segment exist. The subfamily Apicotermitinae as conceived by Grassé & Noirot (1954) has not achieved general recognition up to the present time. This is understandable in view of the small number of genera involved, and the fact that the significance of the gut characters had not been fully worked out. Sufficient evidence has now accumulated to provide a new basis for subfamily classification within the Termitidae. These divisions will reflect more clearly the phylogeny of the group and at the same time incorporate the existing knowledge of other characters more satisfactorily. It is proposed to divide the heterogeneous group hitherto named the Amitermitinae between the Apicotermitinae and the Termitinae, as outlined above. The amalgamation of the second group of Amitermitinae with the Termitinae results in the former name becoming a junior synonym since this group includes the type-genus *Amitermes*. This action was suggested by Noirot (personal communication); having considered the alternative of retaining the five subfamilies, and examined many representatives of all of them I now believe he is right, and here give formal expression to his idea. It may be noted that Ahmad (1950) admitted to doubts of the subfamily status of Amitermitinae. He based the only distinction between them and the Termitinae on the length of the apical teeth of the mandibles. This does not bear comparison with much greater differences within other subfamilies, nor does it hold when further species are examined within the groups as he defined them.

The Nasutitermitinae will be retained as a valid subfamily, although their intestinal morphology is clearly derived from the same stock as the Termitinae. The Macrotermitinae with their short intestine like the more primitive families, and four evenly spaced malpighian tubules at the junction of mesenteron and proctodeum, are distinct from the other three subfamilies. Thus the Termitidae will, with the removal of the Amitermitinae, be divided into four subfamilies as shown in Text-fig. 24. The subfamily Apicotermitinae as now constituted will contain 36



1 ACIDNOTERMES
2 AMALOTERMES
3 ASTALOTERMES
4 ADYNATOTERMES
5 ASTRATOTERMES
6 ALYSCOTERMES
7 AGANOTERMES
8 ACHOLOTERMES
9 AMICOTERMES
10 APAGOTERMES
11 ATEUCHOTERMES
12 ANAOROTERMES
13 ASAGAROTERMES
14 ANENTEOTERMES
15 ADERITOTERMES
16 ADAIPHROTERMES

FIGS 18–23. 18, numbering of enteric valve cushion positions that vary independently; 19, asymmetry of enteric valve resulting from development of positions 3 & 4; 20, asymmetry due to development of position 1; 21–23, comparison of dendrograms of phenetic relationships between genera based on single linkage clustering (21) and median sorting (22) with a hypothetical phylogeny based on conventional criteria (23).

described genera, and several others now known to be awaiting description. They fall readily into two main branches, the more primitive members of which resemble one another in many features, the more specialized diverging considerably in both morphology and behaviour. The formal subfamily diagnosis is followed by a list of the included genera arranged in these two branches and approximately in their hypothetical order of morphological specialization although relationships are distorted by the linear arrangement.

Subfamily **APICOTERMITINAE** Grassé and Noirot

Apicotermitinae Grassé and Noirot, 1954 : 346–388. Type-genus: *Apicotermes* Holmgren, 1912.

Imago. Labrum at least as broad as long, without transverse sclerotized band, tip partly hyaline; mandibles, apical teeth short or longer than first marginal, left third marginal always separated from second by a distinct notch or indentation; fontanelle variable, oval or round to obsolete, never slit-like.

Soldier. Labrum flap-like, not bifurcate or emarginate in front; mandibles fully developed with one or more marginal teeth. This caste absent in some genera.

Worker. Mandibles similar to imago but with apical and marginal teeth and molar plates more prominent.

General characters. Tibial spurs 3 : 2 : 2 or 2 : 2 : 2. Proventriculus without sclerotized armature; malpighian tubules two (*Labidotermes* only) or four, attached separately to epithelium of mesenteron some distance from its junction with the proctodeum; this junction simple, transverse, or overlapping, with mesenteron extended on inner side of curve of intestine, adjacent to insertion of malpighian tubules, and sometimes dilated at posterior end; first segment of proctodeum tubular, never sac-like, sometimes somewhat inflated; enteric valve unarmed or armed with various sclerotized spiny structures, sometimes invaginated into second proctodeal segment or connected to it by a tubular neck which may bear lobes or diverticula at its anterior end.

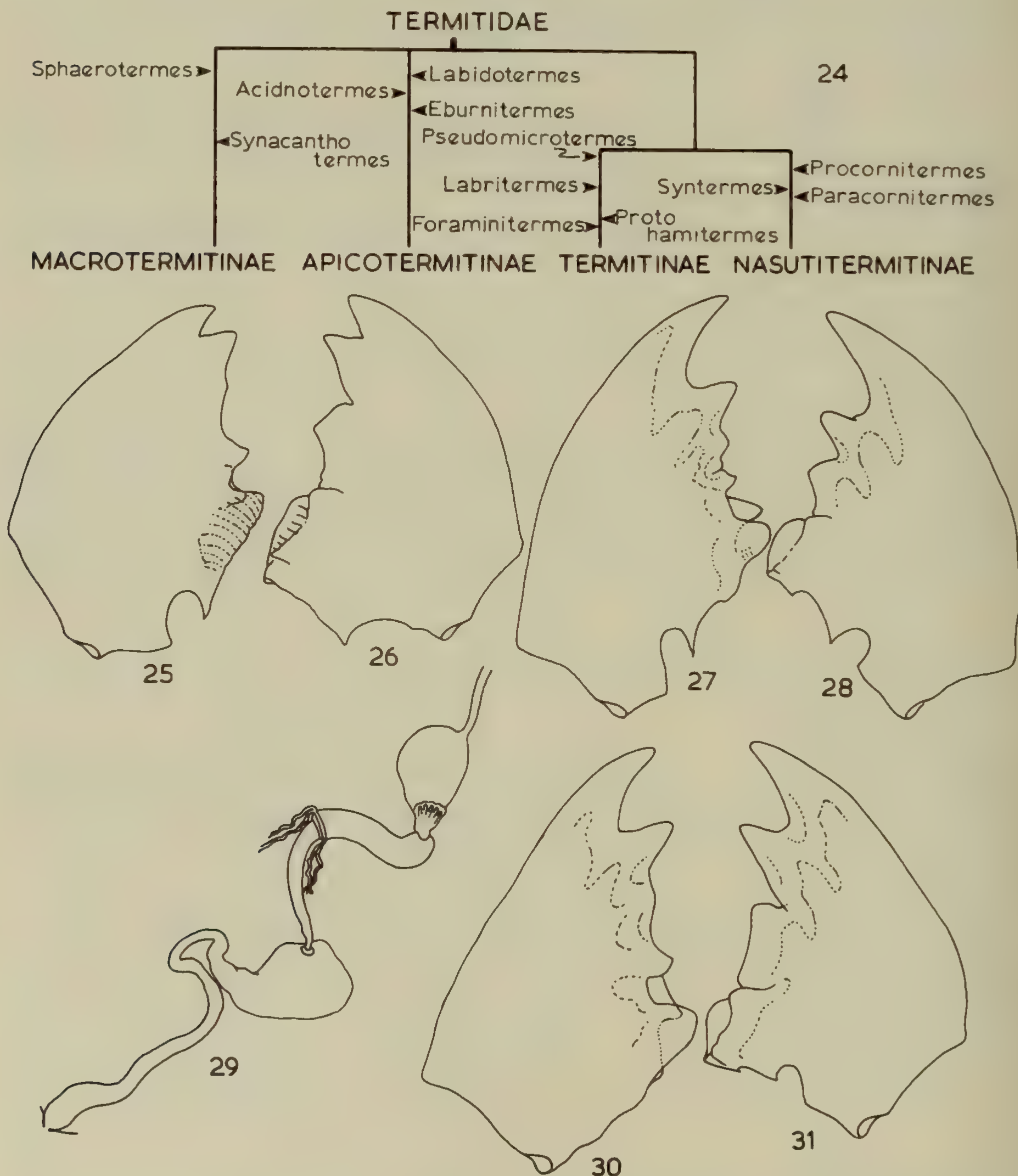
The two branches of this subfamily are named after the most widely known genus in each.

'*Apicotermes*-branch'		'*Anoplotermes*-branch'			
Labidotermes	*Heimitermes*	*Acidnotermes*	*Aganotermes*	*Asagarotermes*	*Euhamitermes*
Eburnitermes	*Coxotermes*	*Amalotermes*	*Acholotermes*	*Anenteotermes*	*Speculitermes*
Trichotermes	*Hoplognathotermes*	*Astalotermes*	*Amicotermes*	*Aderitotermes*	*Doonitermes*
Jugositermes	*Allognathotermes*	*Adynatotermes*	*Apagotermes*	*Anoplotermes*	*Indotermes*
Rostrotermes	*Duplidentitermes*	*Astratotermes*	*Ateuchotermes*	*Adaiphrotermes*	*Firmitermes*
Apicotermes	*Acutidentitermes*	*Alyscotermes*	*Anaorotermes*	*Eurytermes*	

The '*Anoplotermes*-branch' probably includes several different lines. The relationships between the Ethiopian, Neotropical, and Oriental genera need clarification, which will not be attained until the two latter regions are better known. Some of the longest mixed segments are found in species from the Oriental region, yet here the enteric valve appears to be uniformly unarmed. In the Neotropical region some species lack armature in this structure whilst heavily armed sclerotized valves are found in others. In the Ethiopian region the most elaborate armature occurs in forms showing little or no mesenteric overlap with the proctodeum, but parallel structures with almost as great complexity have developed in lines with a moderately long mixed segment.

The systematic order in which this paper is arranged is based on a subjective assessment of increasing specialization away from the assumed primitive forms.

No other particular relationship of the genera is intended to be implied by their linear succession. Having decided upon the species-membership of the genera, it is possible by applying the single linkage criterion to derive generic dendrograms from the phenograms based on single linkage clustering or median sorting of the



Figs 24–31. 24, subdivision of Termitidae into four subfamilies, showing hypothetical positions of some of the more primitive genera in each; 25 & 26, *Labritermes*, mandibles of imago; 27 & 28, *Foraminitermes* ditto; 29, 30 & 31, *Pseudomicrotermes*, intestine of worker caste and mandibles of imago.

similarity matrix. These are compared in Text-figs 21, 22 & 23, with a hypothetical dendrogram based on conventional criteria. The generic phenograms are self-explanatory, the distances on the horizontal axes representing percentage similarities as in the specific diagrams, although the actual figures are omitted. The hypothetical phylogeny is drawn with the junctions equally spaced to represent closer or more distant relationships without attempting to quantify them further. Its main difference from the phenograms is the separation of two types of enteric valve specialization. The first and most frequent tends to develop cushion positions (see Text-fig. 18) 3 and 4 more than 1 and 2 as in Text-fig. 19, and progressing beyond this stage to eversion through the valve opening. The other type has the cushions all equally developed or position 1 extended as in Text-fig. 20. Many of the relationships between genera are discussed in more detail under the generic headings in later sections.

Before leaving the subject of phylogeny and the subfamily classification finally it is necessary to specify the fate of the rest of the Amitermitinae, to avoid leaving certain difficult genera ambiguously placed. Apart from the list already given, all other genera present classified in that subfamily become part of the Termitinae, including *Protohamitermes*, *Hoplotermes* and *Labritermes* which have been regarded as among the 'primitive Amitermitinae'. *Protohamitermes* has been discussed earlier. *Hoplotermes* has a gut pattern virtually identical with *Amitermes* but has adapted to soil-feeding. *Labritermes* is a curious genus that shares with *Foraminitermes* a gut layout resembling some of the Termitinae only in having a dilated first proctodeal segment. The malpighian tubules are attached separately to the simple junction of mesenteron and proctodeum. They are evenly spaced and reflexed forwards on the midgut for a short distance before turning back towards the hind gut in a similar manner to some Macrotermitinae. The soldiers of these two genera have similar mandibles and both also have a hyaline tip to the labrum. In the worker and imago castes the proportions of the mandibular teeth differ, *Foraminitermes* having become adapted to soil-feeding by the elongation of apical teeth and loss of molar ridges. In fresh unworn condition both genera retain the second marginal tooth of the left mandible, while that of the right mandible is in the primitive condition with convex anterior and concave posterior edges. Their mandibles are illustrated in Text-figs 25 & 26, 27 & 28. They must be regarded as among the most primitive members of the Termitinae, that not unexpectedly have features in common with similarly placed members of other subfamilies.

One further genus appears to be related to *Labritermes* and *Foraminitermes* in many respects. The soldier of *Pseudomicrotermes* has similar mandibles and a hyaline tip to the labrum. The fontanelle is open and grooves lead forward from it to the base of the labrum. The imago closely resembles that of *Foraminitermes* in colouring, pilosity, the small open fontanelle raised on a minute projection, and the saddle-shaped pronotum. The tibial spurs number 3 : 2 : 2. The proportions of the apical teeth of imago and worker mandibles are intermediate between the two former genera. In fresh unworn specimens of the imago, the second and third marginal teeth of the left mandible are similarly developed to those of *Labritermes*. The second marginal of the right mandible has the straight-edged cutting form seen

in many higher Termitinae of wood- or herbage-feeding lines, but the molar plate lacks ridges like that of *Foraminitermes*. The most distinctive feature of *Pseudomicrotermes* is the intestine. The first segment of the proctodeum is short, ending in a muscular unarmed enteric valve like that of *Foraminitermes*. The malpighian tubules are inserted as bilaterally opposed pairs at the simple transverse mesenteric-proctodeal junction. The gizzard has well-developed typical armature. Thus the gut has many features in common with more primitive groups and the Macrotermitinae, as do the external characters. Its general similarity to *Foraminitermes* apart from the gut, and the paired malpighian tubules suggest that the only position in which *Pseudomicrotermes* can be classified is as an extremely primitive offshoot near the base of the Termitinae. The intestine of this genus is shown in Text-fig. 29 and the imago mandibles in Text-figs 30 & 31.

Keys to Genera

Before attempting to use the keys it will save time if the specimen to be identified is first measured and a set of ratios is worked out. This can be done with a slide-rule in a few minutes. The keys cannot be worked without the ratios which are essential for discrimination between both genera and species. The measurements that are required are given in the list of characters used for the multivariate analyses under the heading (i) *Continuous variables* (p. 12). The characters concerned are numbers 35–59 inclusive. The fixed points for the more novel measurements are illustrated in Text-figs 1, 2 & 3. It is important that the measurements be taken in millimetres and expressed as decimal fractions, as in the tables given under species-descriptions. If other units are used they will affect the scale of complex ratios with different numbers of terms in numerator and denominator, resulting in gross errors. One measurement is best left until actually needed, namely the greatest diameter of the compound eye. This is normally completely size-correlated and of no value. The only exceptions are found in the monotypic *Amicotermes* and two species of *Ateuchotermes*. The ratios required are as follows:

Imago and worker

1. L_A/L_1 (left mandible index)
2. R_A/R_1 (right mandible index)
3. $L_A/L_1.L_m$ (ratio 1 divided by L_m, distance from third marginal to molar notch)
4. Pcl/W (postclypeus length divided by head width)

Imago alone

5. $L_A.R_A/L_1.L_m$ (ratio 3 multiplied by R_A)
6. $R_1/R_A.R_m$ (note difference from ratio 3 for left mandible)
7. Pcl/R_A (postclypeus length divided by right apical to first marginal)
8. M/W (mesonotum width at constriction divided by head width)
9. L_1/M.N (left first to third marginal divided by product of meso- and metanotal widths)

10. M/R_A (mesonotal width divided by right apical to first marginal)
11. $O_w/O\text{–}E$ (ocellus least diameter divided by ocellus to eye distance)

Worker alone

12. $R_A/R_1.R_m$ (ratio 2 divided by right second marginal to molar notch)
13. Pcl/R_1 (postclypeus length divided by right first to second marginal)
14. T_1/T_w (Fore tibia, length divided by greatest width)
15. $L_m/T_w.L_A$ (complex ratio of tibial width and left mandible measurements)

Imagos

1 Left mandible with proximal end of subsidiary marginal tooth hidden behind molar prominence when viewed from the front (Text-fig. 45). Head capsule very glossy, pilosity of sparse fine setae forming a pelt with regularly spaced paired emergent setae among them. Fore tibia with three apical spurs, third vestigial and difficult to detect. Fontanelle conspicuous elongate-oval, larger than ocellus. Small to medium-sized, W, 0·81–0·90 ***AMALOTERMES*** (p. 47)

– Left mandible with proximal end of subsidiary marginal tooth at least level with edge of molar prominence, clear of it in most genera, when viewed from the front. Head capsule not markedly glossy, pilosity, when it forms a pelt, with scattered, not regular emergent setae. Fore tibia with two or three definite apical spurs, third rarely vestigial. Fontanelle seldom larger than ocellus, if so, either more than twice as large, or entire specimen larger, W, 1·03–1·20 . . 2

2 Fore tibia with only two apical spurs, no trace of third, outer spur ***ADAIPHROTERMES*** (p. 229)

– Fore tibia with three apical spurs, third usually distinct though smaller than inner pair, only vestigial in three widely unrelated species 3

3 Left mandible with proximal end of subsidiary marginal tooth level with edge of molar prominence, viewed from the front 4

– Left mandible with proximal end of subsidiary marginal tooth clear of edge of molar prominence, viewed from the front 8

4 Small, W, 0·57–0·66 . . . . ***ACIDNOTERMES*** (p. 44)

– Larger, W, 0·99–1·21 5

5 Apical teeth of mandibles shorter, L_A/L_1, 0·51–0·57, R_A/R_1, 0·73–0·87 . . . 6

– Apical teeth of mandibles longer, L_A/L_1, 0·79–1·04, R_A/R_1, 1·11–1·45 . . . 7

6 Larger, W, 1·14–1·21. Ocelli separated from compound eyes by two-fifths own least diameter or more. Postclypeus moderately inflated, Pcl/W, 0·27–0·31. Meso- and metanota rather narrow at constriction, M/W, 0·24–0·28, complex ratio L_1/M.N, 1·76–2·32. Pilosity of head uneven, not forming a pelt ***ADYNATOTERMES*** (p. 102)

– Smaller, W, 0·98–1·04. Ocelli very large, almost touching compound eyes or separated by up to one-quarter own least diameter. Postclypeus weakly inflated, Pcl/W, 0·23. Meso- and metanotum wider at constriction, M/W, 0·29–0·33, complex ratio L_1/M.N, 0·54–0·56. Pilosity of head an even pelt with emergent setae . . . . ***ATEUCHOTERMES*** (p. 158)

7 Meso- and metanota wider at constriction, M, 0·31, N, 0·33–0·35, M/W, 0·30–0·32 ***ACHOLOTERMES*** (p. 139)

– Meso- and metanota narrower at constriction, M, 0·24–0·28, N, 0·22–0·27, M/W, 0·21–0·24 . . . . ***AGANOTERMES*** (p. 135)

8 Meso- and metanota proportionately narrower at constriction, M/W under 0·26, or if more, complex ratio L_1/M.N over 2·4. Compound eyes not prominent, somewhat flattened, back of head narrowly rounded behind them. Smaller, W, 0·69–1·10, only two species over 0·98 9

– Meso- and metanota proportionately wider at constriction, M/W over 0·26, or if less, L_l/M.N under 2·4. Compound eyes prominent in proportion to own diameter, back of head more widely rounded. Mostly larger, W, 0·76–1·33, only three species under 0·98 (only one entire range less) 11

9 Apical teeth of mandibles longer, L_A/L_l, 0·78–0·80, R_A/R_l, 1·09–1·18; larger, W, 1·03–1·10 (better separation from other half-couplet given by complex ratios $L_A.R_A/L_l.L_m$, 1·45–1·60; $R_l/R_A.R_m$, 11·5–12·4, but also note size difference) ***ASAGAROTERMES*** (p. 187)

– Apical teeth of mandibles shorter, L_A/L_l, 0·42–0·79, R_A/R_l, 0·62–1·05; smaller, W, 0·65–1·06, those with longer apical teeth, small, W less than 0·85 (complex ratios $L_A.R_A/L_l.L_m$, 0·46–1·37; $R_l/R_A.R_m$, 16·2–31·6 10

10 Postclypeus weakly inflated, without well defined median suture or posterior margin, Pcl/W, 0·20–0·22; small, W, 0·74 . . . ***APAGOTERMES*** (p. 155)

– Postclypeus usually more strongly inflated with median suture and distinct posterior margin, Pcl/W, 0·21–0·36; those species in which not so, larger, W over 0·85
ASTALOTERMES (Group I) (p. 51)
ANENTEOTERMES (p. 192)

11 Apical teeth of mandibles longer, L_A/L_l, 0·68–1·04, complex ratio $L_A/L_l.L_m$, 11·59–16·29. Pilosity of head capsule dense, uneven, not forming a pelt. Fontanelle inconspicuous in species or genera with shortest apical teeth 12

– Apical teeth of mandibles mostly shorter, L_A/L_l, 0·41–0·80 (only two spp. over 0·68, not all specimens of one of these), complex ratio $L_A/L_l.L_m$, 4·54–11·11 (only one sp. over 10·60). In species with mandible characters overlapping with first half-couplet, pilosity of head capsule rather sparse, fine and even, forming a pelt with scattered emergent setae, and fontanelle large or pale and conspicuous 13

12 Compound eyes relatively small, W/E, 4·5, head capsule nearly semi-circular behind them . . . . ***AMICOTERMES*** (p. 152)

– Compound eyes normal sized, W/E, under 4·0, head capsule distinctly less than semi-circular behind them . . . . . . ***ACHOLOTERMES*** (p. 139)

13 Fontanelle shape generally regularly oval to long oval
ASTALOTERMES (Groups II & III) (p. 51)
ALYSCOTERMES (p. 125)
ASTRATOTERMES (p. 105)

– Fontanelle circular or irregular, may be broader than long, outline sometimes indistinct 14

14 Pilosity of head capsule short and even, forming a pelt with longer emergent setae . 15

– Pilosity of head uneven, not forming a pelt 17

15 Fontanelle circular, sharply defined, much paler in colour than head capsule and contrasting with it 16

– Fontanelle irregularly circular or short oval, not sharply defined, paler than head but not contrasting . . . . ***ATEUCHOTERMES*** (p. 158)

16 Ocellus separated from compound eye by less than own least diameter, O_w/O–E, 1·14–2·05. Apical tooth of left mandible shorter, L_A/L_l, 0·54–0·68
ADERITOTERMES (p. 222)

– Ocellus separated from compound eye by approximately own least diameter, O_w/O–E, 0·96–1·07. Apical tooth of left mandible longer, L_A/L_l, 0·68–0·78
ASTRATOTERMES (p. 105)

17 Fontanelle circular, pale, only slightly smaller than ocellus. Postclypeus with evenly rounded posterior margin . . . . . ***ASTRATOTERMES*** (p. 105)

– Fontanelle irregular, nearly triangular, less than half size of ocellus. Postclypeus with posterior margin rounded in middle, straighter towards outer corners
ANAOROTERMES (p. 184)

Workers

1 Mixed segment of gut long, anterior termination of proctodeal overlap distinctly to left side of malpighian knot in ventral view (Text-figs 520–532, 585–603, 621–627 & 648–658) 2

– Mixed segment of gut short, anterior end of proctodeal overlap on right side of malpighian knot or at most within it in ventral view, or junction between mesenteron and proctodeum transverse, without overlap, mixed segment absent . 4

2 Mesenteron with spherical or hemispherical dilation at posterior end of mixed segment. Fore tibia moderately to strongly inflated, T_I/T_W, 3·08–4·00, with only two apical spurs. Enteric valve without armature, surface of cushions reticulated, sometimes scaly at anterior ends . . . . ***ADAIPHROTERMES*** (p. 229)

– Mesenteron not distinctly dilated at posterior end of mixed segment. Fore tibia not or moderately inflated, T_I/T_W, 3·58–5·31, with three apical spurs. Enteric valve cushions with scaly surface, or armed with spines or spicules, sometimes protruding through valve opening at posterior ends (Plates 7, 8 & 9, excl. figs 10–12) . 3

3 Enteric valve seating fully mid-dorsal in position in unopened abdomen (Text-fig. 6) with three equal and conspicuous lobes. Cushions of valve all equally developed, thickly armed at posterior ends with elongated spicules or protruding through valve opening as transparent flattened vanes. Larger, W, 0·90–1·00; complex ratio $L_m/T_W.L_A$, 3·23–4·83 . . . . . . ***ADERITOTERMES*** (p. 222)

– Enteric valve seating lateral or dorso-lateral in position in unopened abdomen, with two or three weak lobes. Cushions of valve not equally developed, positions 3 and 4 larger, sometimes protruding through valve opening, armature when present spiny, not spicules. Smaller, W, 0·56–0·84; complex ratio $L_m/T_W.L_A$, 5·01–7·85 . . . . ***ANENTEOTERMES*** (p. 192)

4 Enteric valve cushions armed posteriorly with conspicuous spines or spicules protruding through valve opening 5

– Enteric valve cushions unarmed posteriorly, or with minute spines or spicules not protruding through valve opening 10

5 Armature of enteric valve more or less radially symmetrical with all cushions nearly equally developed 6

– Armature of enteric valve asymmetrical with one or two cushion positions much more developed than the rest 8

6 Head capsule brown. Left mandible with proximal end of subsidiary marginal tooth hidden behind molar prominence in surface view. Third spur of fore tibia vestigial. Overlap between mesenteron and proctodeum diagonal. Armature of enteric valve of short stout spines on posterior ends of cushions only (Pl. 1) ***AMALOTERMES*** (p. 47)

– Head capsule yellow. Left mandible with proximal end of subsidiary marginal tooth not hidden behind molar prominence. Third spur of fore tibia distinct. Junction between mesenteron and proctodeum nearly transverse, no appreciable overlap. Armature of enteric valve of long thin spines or spicules extending from about half length of cushions to distal ends 7

7 Smaller, W, 0·58. Apical teeth of mandibles shorter, L_A/L_I, 0·52. Postclypeus less inflated, Pcl/R_I, 1·80. Enteric valve seating with very short neck, weakly 2- or 3-lobed. Armature of enteric valve arranged in rather regular transverse rows, subsidiary spines below distal fringe slightly spatulate at tips (Pl. 4) ***APAGOTERMES*** (p. 155)

– Larger, W, 0·76. Apical teeth of mandibles longer, L_A/L_I, 1·09. Postclypeus more inflated, Pcl/R_I, 3·28. Enteric valve seating with very long neck, definitely 3-lobed. Armature of enteric valve not regularly arranged, all spines thin and evenly tapered (Pl. 3) . . . . ***AMICOTERMES*** (p. 152)

8 Enteric valve cushions in positions 3 and 4, and their armature, much more strongly developed than positions 1 and 2 (Text-fig. 19) 9
– Enteric valve cushion in position 1 elongated and its armature more strongly developed than positions 2 3 and 4, which are subequal (Text-fig. 20) ***ATEUCHOTERMES*** (p. 158)
9 Enteric valve cushions in position 3 everted, hemispherical, and armed with stout spines; position 4 fork-like, with 7–8 curved tines; other positions reduced, two with 1–2 spines, one absent (Pl. 7) . . . ***ANAOROTERMES*** (p. 184)
– Enteric valve cushions in positions 3 and 4 fringed with stout spines other positions smaller with few spines or none (Pl. 2) . . . ***ALYSCOTERMES*** (p. 125)
10 Left mandible with proximal end of subsidiary marginal tooth hidden behind molar prominence in surface view. Very small, W, 0·48–0·57 ***ACIDNOTERMES*** (p. 44)
– Left mandible with proximal end of subsidiary marginal tooth clear of molar prominence in surface view. Larger, W, 0·58–1·09 11
11 Enteric valve armature consisting of sclerotized spiked coronet-like bands, one girdling the middle of each cushion, all equally developed (Pl. 7) ***ASAGAROTERMES*** (p. 187)
– Enteric valve armature not so 12
12 Enteric valve unarmed, cushions with reticulate or scaly surface, single exception smaller, W, 0·64–0·69 13
– Enteric valve armature, edges of scales on cushion surface each produced into one or more small spines or spicules, generally larger, W, 0·70–1·09. 15
13 Apical teeth of mandibles very long, L_A/L_l, 0·97–1·00, R_A/R_l, 1·25–1·29; complex ratio $L_A/L_l.L_m$, 25·81–26·66 . . . . ***AGANOTERMES*** (p. 135)
– Apical teeth of mandibles shorter, L_A/L_l, 0·43–0·86, R_A/R_l, 0·57–1·08; complex ratio $L_A/L_l.L_m$, 7·25–18·60 14
14 Enteric valve seating ventral on left side of unopened abdomen, with two prominent bilaterally opposed erect lobes (virtually diverticula) ***ADYNATOTERMES*** (p. 102)
– Enteric valve seating ventro- to dorso-lateral, weakly to prominently 2- or 3-lobed but never with erect opposed diverticula . . ***ASTALOTERMES*** (p. 51)
15 Apical teeth of mandibles longer, complex ratios $L_A/L_l.L_m$, 20·75–22·89, $R_A/R_l.R_m$, 22·80–30·15. Postclypeus more inflated, Pcl/R_l, 2·57–2·88 ***ACHOLOTERMES*** (p. 139)
– Apical teeth of mandibles shorter, complex ratios $L_A/L_l.L_m$, 7·47–18·61, $R_A/R_l.R_m$, 8·86–21·90. Postclypeus less inflated, Pcl/R_l, 1·65–2·60, only one specimen recorded over 2·4 . . . . . ***ASTRATOTERMES*** (p. 105)

ACIDNOTERMES gen. n.

(Akidnos, Gr., 'Weak, feeble')

Type-species: *Acidnotermes praus* sp. n.

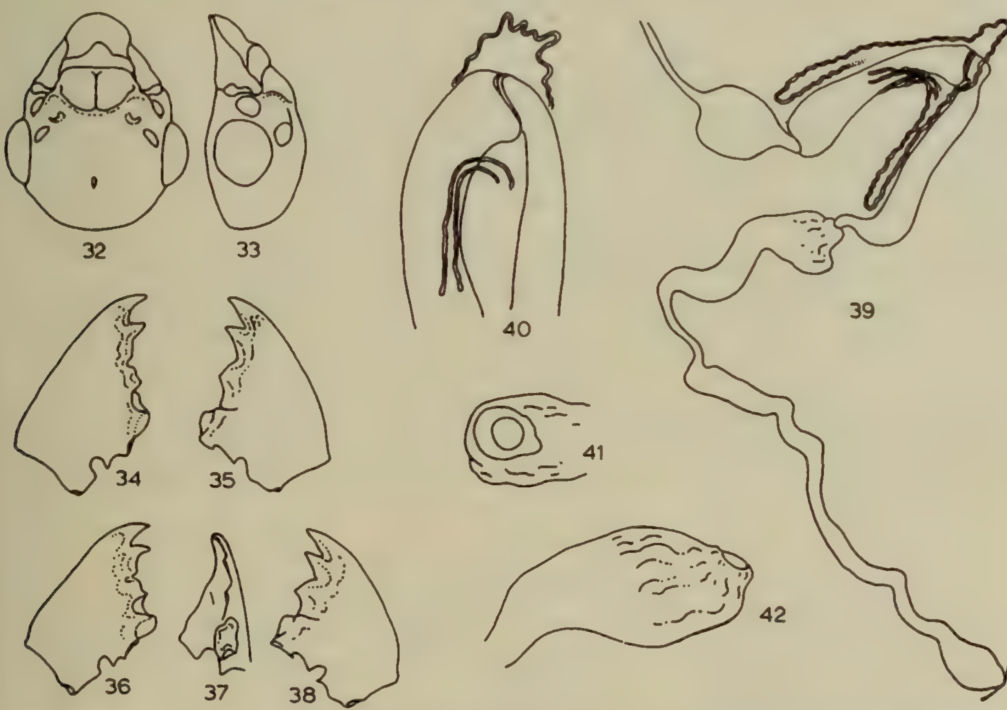
Imago. Very small, W, 0·57–0·66. Fore tibia with three apical spurs, third well developed, two-thirds length of other two. Apical teeth of mandibles short, L_A/L_l, 0·50–0·56, R_A/R_l, 0·62–0·71; subsidiary marginal tooth of left mandible with proximal end just level with edge of molar prominence in surface view, complex ratio $L_A/L_l.L_m$, 10·00–14·41. Right mandible with points of apical and marginal teeth in line, but second marginal wide with anterior edge longer than that of first marginal. Meso- and metanota narrow at constriction, M/W, 0·21, transverse dark sutures weak but present.

Worker. Very small, W, 0·48–0·57. Fore tibia moderately swollen, T_l/T_w, 3·46–3·94, with three apical spurs, third nearly as large as other two. Apical teeth of mandibles short, L_A/L_l, 0·48–0·54, R_A/R_l, 0·60–0·68; subsidiary marginal tooth of left mandible with proximal end hidden behind molar prominence in surface view, complex ratio $L_A/L_l.L_m$, 11·55–14·72.

Right mandible similarly proportioned to that of imago except for enlarged molar plate, complex ratio $R_A/R_1.R_m$, 13·40–18·15. Mesenteric junction with proctodeum simple, nearly transverse, without overlap, mesenteron short with malpighian tubules inserted at exactly half its length. First section of proctodeum slightly longer than mesenteron, slightly swollen, tapering distally to enteric valve; valve seating a simple rim, sessile on second pouch of proctodeum, latero-ventral in position in unopened abdomen; internal cushions of enteric valve, unarmed, weakly scaled.

This genus, represented so far by a single species, is clearly related to *Astalotermes*, and particularly to *A. comis* sp. n. However, the position of the subsidiary marginal tooth of the left mandible, and the distinctly shorter gut of the worker, are both features resembling more primitive groups. The results of the various numerical taxonomic analyses also separate *Acidnotermes* to such an extent that it must be placed in a different genus. Its small size and mandible form combined distinguish it from all other genera. The only overlap in size is found in *Anenteotermes nanus* (Sjöstedt) but here the mandibles are distinctive in both castes, and the worker with its long mixed segment of the gut, and armed enteric valve, presents no problems.

The relative shortness of the worker gut, the lack of a mixed segment, the unarmed enteric valve, and the unspecialized mandibles, all lead to the opinion that *Acidno-*



FIGS 32–42. *Acidnotermes praus*. 32, 33, front and side views of imago head capsule; 34, 35, imago mandibles; 36–38, worker ditto; 39, entire worker intestine; 40, mesenteric-proctodeal junction showing attachment of malpighian tubules and position of malpighian knot; 41, 42, views of enteric valve seating.

termes probably closely resembles the ancestral forms of the group. This is why *Acidnotermes* is placed first in the systematic order of arrangement of this paper. The only external characters of worker or imago that I would regard as likely to be specialized are the swollen fore tibia of the former and the narrow meso- and metanota of the latter. The insertion of the malpighian tubules at the mid-point of the mesenteron instead of nearer to the junction with the proctodeum probably also represents a specialization carried a little further in this genus than in any other.

Acidnotermes praus sp. n.

(Text-figs 32–42; Pl. 1, fig. 1)

Imago. Head capsule brown, sepia-brown above ocelli, dark areas sometimes extending as tapering streaks converging to fontanelle; fontanelle minute, circular to elongate oval, slightly raised on small bump, pale yellow-brown; medial spot circular or short oval, smaller than fontanelle, also raised on small bump, brown; postclypeus pale brown, labrum pale yellow; frontal marks very indistinct pale brown; antennae pale yellow-brown. Pronotum, meso- and metanota pale brown; legs, femora and tibiae pale yellow-brown, tarsi pale yellow. Abdominal tergites pale yellow-brown, dorsal stigmata paler, yellow; sternites, very pale yellow-brown laterally, yellow-white in middle, ventral stigmata darker, pale yellow-brown, cerci yellow-white.

Posterior margin of head capsule evenly rounded except immediately behind compound eyes, ocelli proportionately rather large, separated from eyes by less than half own least diameter, nearly touching in some specimens; postclypeus moderately inflated, Pcl/W, 0·25–0·30 posterior margin rounded, somewhat more arched in middle, median suture distinct. Pilosity of head capsule very dense, pale, slightly uneven in length, scarcely forming a pelt.

Measurements (10 specimens from five localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	0·57–0·66	0·596 ± 0·030
Ocellus ($O_w \times O_l$) . .	0·05–0·06 × 0·07–0·09	0·058 ± 0·004 × 0·077 ± 0·006
Ocellus to eye (O–E) .	0·01–0·02	0·014 ± 0·005
Postclypeus length (Pcl) .	0·15–0·18	0·160 ± 0·009
Antennal article III . .	0·01–0·02	0·015 ± 0·003
Antennal article IV . .	—	0·022 ± 0·002
Antennal article V . .	0·02–0·03	0·023 ± 0·002
Left mandible, apical to first marginal (L_A) .	0·04–0·05	0·045 ± 0·002
Left mandible, first to third marginal (L_l) . .	0·08–0·09	0·085 ± 0·004
Left mandible, third marginal to molar (L_m) .	0·04–0·05	0·045 ± 0·003
Right mandible, apical to first marginal (R_A) .	0·04–0·05	0·047 ± 0·002
Right mandible, first to second marginal (R_l) .	0·06–0·08	0·071 ± 0·005
Right mandible, second marginal to molar (R_m) .	0·04–0·05	0·046 ± 0·003
Mesonotum width (M) .	0·10–0·15	0·128 ± 0·002
Metanotum width (N) .	0·10–0·14	0·121 ± 0·002

Worker. Head capsule pale yellow, pilosity yellow, fairly numerous but very short. Postclypeus strongly inflated, Pcl/W, 0·33–0·36, Pcl/R_l, 2·83–3·19. Membranous wall of enteric valve beyond cushions with sparse minute spicules. Other characters given in generic diagnosis.

Measurements (five specimens from five localities) in millimetres.

	Range	Mean ± S.D.
Head width (W)	0·48–0·57	0·519 ± 0·032
Fore tibia width (T_w)	—	0·099 ± 0·001
Fore tibia length (T_l)	0·34–0·39	0·358 ± 0·021
Postclypeus length (Pcl)	0·17–0·19	0·182 ± 0·009
Left mandible, apical to first marginal (L_A)	—	0·039 ± 0·002
Left mandible, first to third marginal (L_l)	0·07–0·08	0·076 ± 0·004
Left mandible, third marginal to molar (L_m)	—	0·038 ± 0·002
Right mandible, apical to first marginal (R_A)	—	0·039 ± 0·002
Right mandible, first to second marginal (R_l)	0·06–0·07	0·061 ± 0·004
Right mandible, second marginal to molar (R_m)	0·04–0·05	0·039 ± 0·004

The distinguishing features of this species are discussed under the generic heading, and some details of its phylogenetic significance are mentioned in the section on the phylogeny of the group as a whole. The abdomen of the worker caste appears to be dehiscent in at least some specimens but this characteristic does not seem to be as strongly developed as in some species of *Astalotermes*.

Holotype ♀ imago, paratype ♂ and ♀ imagos, and workers from type-colony, DEMOCRATIC REPUBLIC OF CONGO: Stanleyville, 27.v.1948 (*A. Emerson*), in American Museum of Natural History.

Other paratype material. DEMOCRATIC REPUBLIC OF CONGO: Luluabourg, xi.1929 (*J. Ghesquière*); Camp Putnam, Epulu R., 20.v.1948, Stanleyville, 25, 27.v, and 1.vi.1948, five vials, 20 km E. of Ndjili and 18 km S. of Leopoldville [Kinshasa], 10.vi.1948 (*A. Emerson*); Kinshasa, 5.xii.1959, two vials, 25.vi.1960, 1.x.1966, Mpenzara, 7.ix.1966 (*A. Bouillon*); Kinshasa, 13.v.1965, two vials, Mount Gafula, 30 km S. of Knshasa, on Matadi Road, 4.x.1966 (*C. Nkakala*); Mondongo, Lisala, 27–28.ix.1966, three vials (*J. Ruelle*). Material in AMNH, BMNH and Coll. A. Bouillon, University of Lovanium, Kinshasa.

A total of 20 nest-series were examined.

The species appears to be fairly common in the Congo Forest block, where it has been found in small compact earth-carton nests 10–15 cm in diameter, on or below the soil surface, as well as in the mounds of other species, in surface debris, and under dead wood.

AMALOTERMES gen. n.

(Amalos Gr., 'soft, tender, or weak')

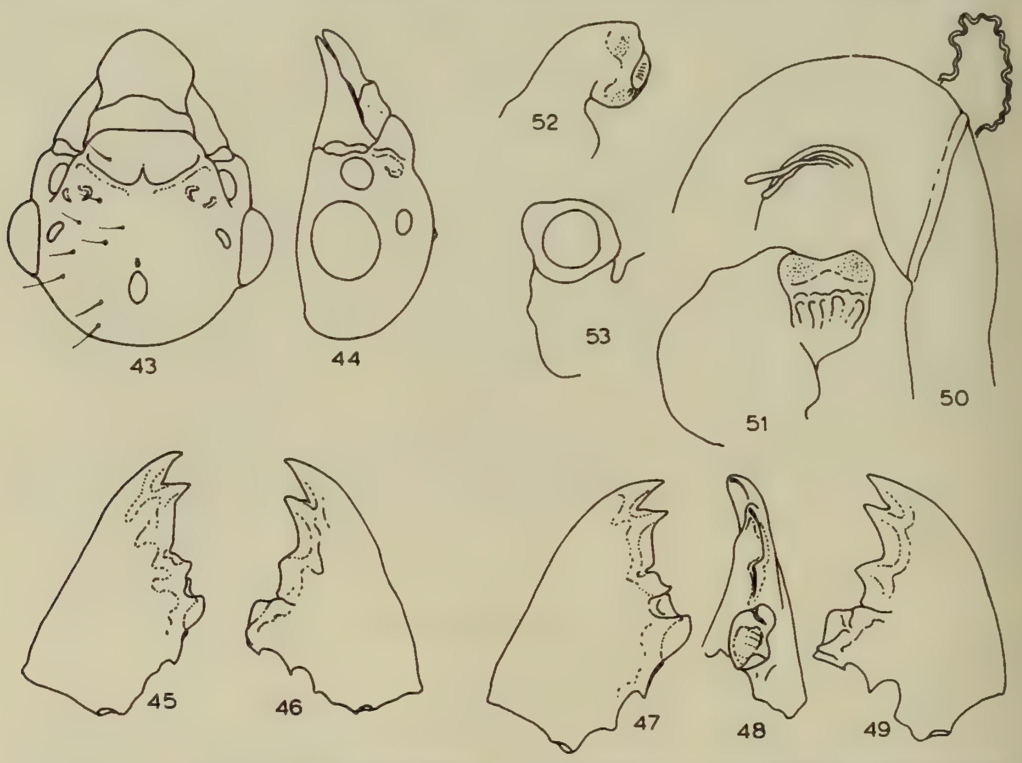
Type-species: *Amalotermes phaeocephalus* sp. n.

Imago. Medium-sized, W, 0·81–0·90. Fore tibia with three apical spurs, but third vestigial, almost lost in some specimens. Apical teeth of mandibles short, L_A/L_l, 0·38–0·48, R_A/R_l, 0·56–0·65; subsidiary marginal tooth of left mandible with proximal end hidden behind molar prominence in surface view, complex ratio $L_A/L_l.L_m$, 6·50–8·29. Right mandible with anterior edge of first marginal tooth about as long as that of second, its point slightly behind the line of

apical and second marginal teeth. Meso- and metanota fairly wide at constriction, M/W, 0·25–0·28, transverse dark sutures distinct, usually sharp and clear, sometimes more diffuse.

Worker. Medium-sized, W, 0·74–0·79. Fore tibia slender, T_l/T_w, 6·14–6·43, with three apical spurs, but third vestigial, almost lost in most specimens. Apical teeth of mandibles short, L_A/L_l, 0·41–0·51, R_A/R_l, 0·53–0·66; subsidiary marginal tooth of left mandible with proximal end hidden behind molar prominence in surface view, complex ratio $L_A/L_l.L_m$, 8·60–9·40. Right mandible with anterior edge of first marginal tooth distinctly shorter than that of second, complex ratio $R_A/R_l.R_m$, 10·59–11·20. Mesenteric overlap at junction with proctodeum about twice as long as width of mesenteron at insertion of malpighian tubules, reaching half way through malpighian knot. Enteric valve seating weakly two-lobed, connected to second pouch of proctodeum by a short neck, lateral in position in unopened abdomen; internal cushions of enteric valve all more or less equally developed and armed distally with prominent stout spines protruding through valve opening.

The single species of *Amalotermes* presents an unusual mosaic of characters, some regarded as primitive, others as specialized, which makes it impossible to fit it into a genus with any other known species. This conclusion, reached by conventional means, is confirmed by its position in the various multivariate analyses. In both single linkage and median clustering methods of examining the similarity matrix it is in the last three species to be grouped, and this isolation is confirmed by the



Figs 43–53. *Amalotermes phaeocephalus.* 43, 44, front and side views of imago head capsule; 45, 46, imago mandibles; 47–49, worker ditto; 50, mesenteric-proctodeal junction showing attachment of malpighian tubules and position of malpighian knot; 51–53, views of enteric valve seating.

principal co-ordinates, plotted in Text-fig. 12. Its nearest neighbour in these analyses is another isolated species, *Apagotermes stolidus* sp. n. From this it differs in the imago by the proportions and positions of the mandibular teeth, the large and conspicuous fontanelle, the wider meso- and metanota, and the vestigial third spur of the fore tibia. In the worker, the mandible and fore tibia spur characters also apply; moreover, *Amalotermes* has a longer mesenteric overlap with the proctodeum, and very different enteric valve armature from *Apagotermes*. The same characters also serve to distinguish *Amalotermes* from similarly sized members of the other genera such as *Astalotermes* and *Anenteotermes*.

The relationships of *Amalotermes* to other genera are not easy to assess. The mandible form and slender fore tibia of the worker are features common to the more primitive members of the group and the brown head of the worker caste recalls genera such as *Speculitermes*. Its liking for rotting wood also suggests a lack of specialization in habits. However, the reduced alate pilosity and vestigial third tibial spur are derivative characters as are, in the worker, the already more elongated gut and well developed enteric valve armature. It most probably represents a persistent early offshoot from the main group, and has developed its own specialized characters; some of these are convergently resembled by other genera that perhaps diverged from the main stem rather later on.

Amalotermes phaeocephalus sp. n.

(Text-figs 43–53; Pl. 1, fig. 2)

Imago. Head capsule very glossy dark sepia-brown, sometimes darker above ocelli; fontanelle larger than ocellus, oval, flat or slightly depressed, pale brown; medial spot minute, oval, slightly raised on small bump, sepia-brown; postclypeus sepia-brown, labrum brown; frontal marks almost obsolete, flat, sepia-brown; antennae, sepia-brown. Pronotum sepia-brown, meso- and metanota brown; legs entirely yellow-white. Abdominal tergites sepia-brown, sternites laterally brown, pale yellow in middle, abdominal stigmata almost absent, coloured as sclerites; cerci very pale brown.

Posterior margin of head capsule evenly rounded, ocelli rather small, separated from compound eyes by three-quarters own least diameter or more; postclypeus not strongly inflated, Pcl/W, 0·21–0·24, posterior margin rounded, more arched in middle, median suture absent or very weakly developed. Pilosity of head capsule rather long, somewhat sparse and fine, brown, forming a very distinct long pelt with regularly placed paired emergent setae.

Measurements (three specimens from three localities) in millimetres.

	Range	Mean
Head width across eyes (W)	0·81–0·90	0·848
Ocellus ($O_w \times O_l$)	0·06–0·07 × 0·09–0·10	0·063 × 0·091
Ocellus to eye (O–E)	0·05–0·06	0·056
Postclypeus length (Pcl)	0·18–0·21	0·190
Antennal article III	0·04–0·06	0·048
Antennal article IV	—	0·049
Antennal article V	—	0·050
Left mandible, apical to first marginal (L_A)	0·05–0·06	0·053
Left mandible, first to third marginal (L_1)	0·12–0·13	0·121

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Left mandible, third marginal to molar (L_m)	0·05–0·06	0·058
Right mandible, apical to first marginal (R_A)	0·05–0·07	0·060
Right mandible, first to second marginal (R_l)	0·09–0·10	0·097
Right mandible, second marginal to molar (R_m)	0·05–0·06	0·058
Mesonotum width (M)	0·21–0·25	0·224
Metanotum width (N)	0·20–0·29	0·238

Worker. Head capsule brown, pilosity yellow-brown, fontanelle conspicuous, very pale brown; antennae sepia-brown. Postclypeus not strongly inflated, Pcl/W, 0·22–0·25, Pcl/R_l, 1·86–1·91. Membranous wall of enteric valve beyond cushions with sparse minute spicules. Other characters given in generic diagnosis.

Measurements (three specimens from three localities) in millimetres.

	Range	Mean
Head width (W)	0·74–0·79	0·754
Fore tibia width (T_w)	0·09–0·10	0·091
Fore tibia length (T_l)	0·54–0·63	0·575
Postclypeus length (Pcl)	0·16–0·18	0·175
Left mandible, apical to first marginal (L_A)	0·05–0·06	0·053
Left mandible, first to third marginal (L_l)	0·11–0·12	0·115
Left mandible, third marginal to molar (L_m)	0·05–0·06	0·051
Right mandible, apical to first marginal (R_A)	0·05–0·06	0·053
Right mandible, first to second marginal (R_l)	0·09–0·10	0·093
Right mandible, second marginal to molar (R_m)	0·05–0·06	0·053

The comparisons of this species with others are largely made under the generic heading, and its relationships are also discussed. There is little to add except that the abdomen of the worker caste appears to have at least a tendency to dehiscence. One further curious feature is the lack of male imagos in the collections. Long nest-series are available with many de-alated semi-physogastric females and numerous eggs and larvae, but only a single male is known. This is not from one of these long series, which perhaps may provide examples of parthenogenetic colonies, a phenomenon rare in termites.

Holotype ♀ imago, paratype ♀ imagos and workers from type-colony, NIGERIA: Eastern Region, 40 miles from Port Harcourt on Owerri Road, 19.vi.1957 (*W. Wilkinson*, Coll. No. WW747), in British Museum (Natural History).

Other paratype material. NIGERIA: Western Region, Sobo Plain, Obanokoro, 4.iii.1957, Eastern Region, 40 m. and 36 m. from Port Harcourt on Owerri Road, 19.vi.1957, 2 vials, and 5.xii.1957 (*W. Wilkinson*). GABON: Belinga, 13.vi.1962 (*J. Deligue*). DEMOCRATIC REPUBLIC OF CONGO: Camp Putnam, Epulu R., 20.v.1948, and Stanleyville, 27.v.1948 (*A. Emerson*) in AMNH; Kivu, Irangi, 3 and 7.xi.1963 (*E. Ernst*) his own collection.

A total of nine nest-series were examined.

Although not particularly common, this species seems to be widespread in the

equatorial part of the Congo forest. It has been found in the old decaying mounds of other species, and in moist rotting wood, under bark, and similar situations.

ASTALOTERMES gen. n.

(Astales, Gr., 'unarmed')

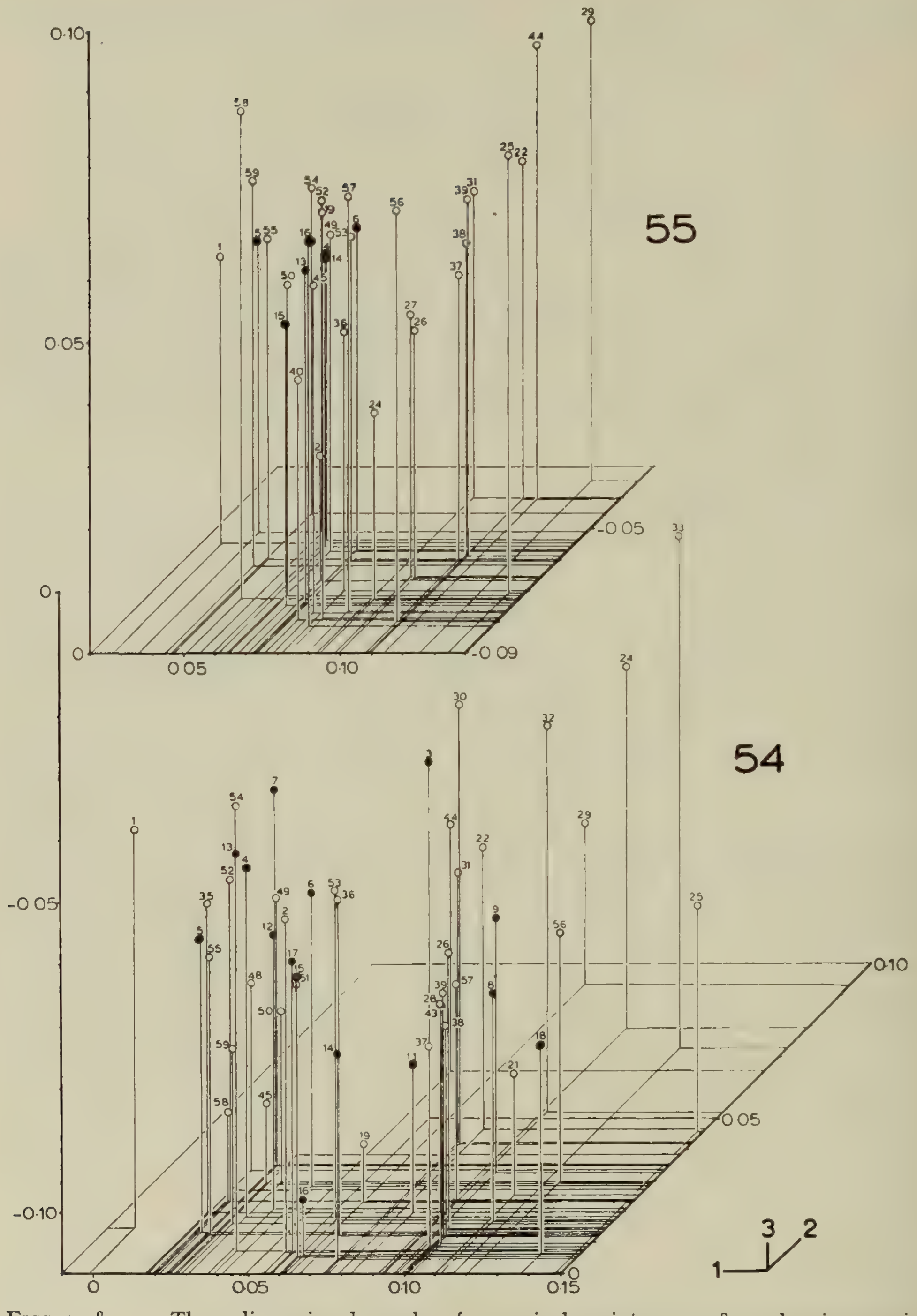
Type-species: *Anoplotermes concilians* Silvestri, 1914 : 58.

Imago. Small to large, W, 0·69–1·33. Fore tibia with three apical spurs, third usually only slightly smaller than other two, sometimes vestigial. Apical teeth of mandibles vary in length from short to fairly long, L_A/L_l, 0·41–0·79, R_A/R_l, 0·55–1·05; subsidiary marginal tooth of left mandible with proximal end just clear to distinctly clear of molar prominence in surface view, complex ratio $L_A/L_l.L_m$, 4·54–13·20. Right mandible with points of apical and marginal teeth in line, or first marginal retracted behind line from apical to second marginal; anterior edge of first marginal longer than that of second, equal to it, or shorter. Meso- and metanota from narrow to wide at constriction, M/W, 0·20–0·36, meso- and metanotal sutures present to absent.

Worker. Small to large, W, 0·58–1·08. Fore tibia slender to moderately swollen, T_l/T_w, 3·86–5·96 with three apical spurs, third usually distinct but sometimes vestigial. Apical teeth of mandibles short to fairly long, L_A/L_m, 0·43–0·86, R_A/R_l, 0·57–1·08; subsidiary marginal tooth of left mandible with proximal end just clear to distinctly clear of molar prominence in surface view, complex ratio $L_A/L_l.L_m$, 7·25–18·60. Right mandible, with points of apical and marginal teeth in line, or first marginal retracted; anterior edge of first marginal slightly longer than that of second, equal to it, or shorter, complex ratio $R_A/R_l.R_m$, 9·94–22·15. Mesenteric junction with proctodeum varies from almost transverse to overlapping by about twice width of mesenteron at insertion of malpighian tubules, proximal end of proctodeum touching malpighian knot. Enteric valve seating variable, weakly lobed and sessile to distinctly two- or three-lobed and connected to second pouch of proctodeum by a definite neck, ventro to dorsolateral in position in unopened abdomen; internal cushions of enteric valve unarmed, surface scaly.

A genus that occupies a transitional position between others with more primitive and more specialized characters is always difficult to define and *Astalotermes* is no exception to this. The diagnoses given above clearly include so wide a range of variation that they overlap to some extent with several other genera, particularly in the imago caste. It will be noted from the keys to genera that imagos alone are not always reliably identifiable at this level; the worker caste usually gives a clearer set of characters. The short mesenteric overlap with the proctodeum distinguishes it from *Adaiphrotermes*, *Anenteotermes* and *Aderitotermes*. The unarmed enteric valve separates it from many monotypic genera, from *Alyscotermes* and *Ateuchotermes*, and from its near relative *Astratotermes* in which the scales bear small teeth. *Adynatotermes* is clearly closely related but has a more specialized enteric valve seating; *Aganotermes* and *Acholotermes* have longer apical teeth to the mandibles in both imago and worker castes. The relationship to *Acidnotermes* is indicated under that genus.

The species now placed in *Astalotermes* were grouped differently at earlier stages in this revision. The multivariate analyses of measurements alone—canonical variates (Text-figs 54 & 55) and principal components—produced compact groupings of some of the species, but others now included were scattered more widely or



FIGS 54 & 55. Three-dimensional graphs of canonical variates 1, 2 & 3, showing species of *Astalotermes* as solid spots. 54, imago, 55, worker caste.

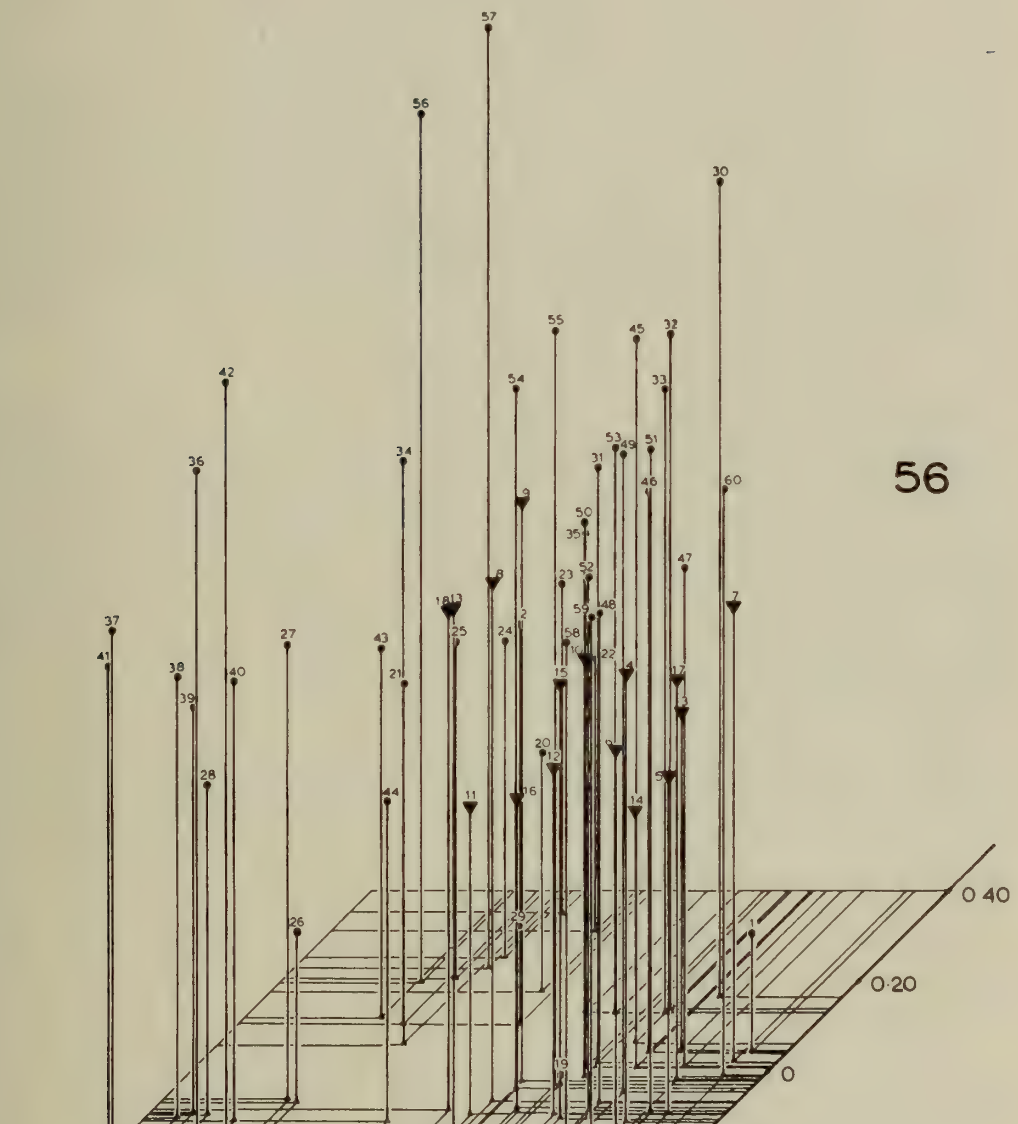


FIG. 56. Three-dimensional graph of principal co-ordinates analysis-plot of eigenvectors 1, 3 & 5 showing species of *Astalotermes* marked by large triangles forming a loose cluster.

grouped at some distance from the rest. Various arrangements were tried in efforts to obtain well-defined genera. These were based in turn on differences in the position and form of the worker enteric valve seating, in the proportions of imago and worker mandibles, and in the widths of imaginal thoracic nota. However, the results of cluster and vector analyses of the similarity matrix placed the species in a single rather large loose cluster, near to the genera *Adaiphrotermes*, *Acholotermes* and *Anenteotermes* (Text-fig. 56). When the stage of preparing keys to genera was reached it quickly became clear that the groupings previously tried would not key out at all. For practical purposes the grouping indicated by overall similarity was better than any of the others tried earlier, and was therefore adopted. It should be noted that consequent on the heavy weighting imposed on the enteric valve characters by the coding used, the genus is essentially defined by its lack of armature in this feature.

Species-Groupings

Although the earlier attempts at clustering proved to be at too low a level, some of the groups so formed remain recognizable as species-groups within the genus *Astalotermes*. Having considered the possibility that they could be treated as subgenera, I now think it is better to deal with them informally. They are of value in indicating more clearly the affinities of *Astalotermes* with other genera, but the groups are not so well-defined that any useful purpose would be served by naming them. As usual, there are some species that appear to be related to more than one group and do not readily fall into any of them. The arrangement of the species descriptions following the keys conforms to these general groupings, as indicated below.

Group I. Smaller species, W, (Imago) 0·69–0·86; apical teeth of mandibles longer, L_A/L_1 (Imago) 0·50–0·79, (Worker) 0·56–0·86; imago, meso- and metanota rather consistently narrower at constriction, M/W, 0·20–0·28; worker, enteric valve seating lateral or dorsolateral in unopened abdomen, sessile to strongly necked, weakly to distinctly two-lobed. Species included: *A. amicus* sp. n., *A. benignus* sp. n., *A. comis* sp. n., *A. concilians* (Silvestri), *A. eumenus* sp. n., *A. amicus* and *A. eumenus* have longer apical teeth than the other species. These, and their strongly necked enteric valves may indicate a leaning towards *Acholotermes*. At the other end of the group, *A. comis* is clearly related to *Acidnotermes*.

Group II. Larger species, W, (Imago) 0·98–1·23; apical teeth of mandibles a little shorter in some species, (Imago) 0·55–0·66 (Worker) 0·62–0·79; imago, meso- and metanota variably wider at constriction, M/W, 0·26–0·32; worker, enteric valve seating ventrolateral to lateral in unopened abdomen, long-necked, distinctly two- or three-lobed. Species included: *A. aganus* sp. n., *A. hapalus* sp. n., *A. ignavus* sp. n., *A. mitis* sp. n. and *A. murcus* sp. n. *A. ignavus* and *A. murcus* are more closely related to each other than to the rest, with their extremely long head-setae. The other three species may represent a link with genera such as *Alyscotermes* and perhaps *Astratotermes*. It is also likely that *Adynatotermes* and *Aganotermes* are derived from forms like these.

Group III. Medium-sized to larger species, W, (Imago) 0·76–1·20; apical teeth of mandibles somewhat shorter. L_A/L_1, (Imago) 0·41–0·64, (Worker) 0·43–0·64; right mandible of worker with anterior edge at first marginal tooth much shorter than that of second; imago, meso- and metanota variably somewhat wider than Group I. M/W, 0·23–0·34; worker enteric valve seating ventro- to dorsolateral in unopened abdomen, sessile or short-necked, weakly two- or three-lobed. Species included: *A. acholus* sp. n., *A. brevior* (Holmgren), *A. obstructus* sp. n., *A. quietus* (Silvestri). This group is the most specialized in the genus, with the distinctly reduced first marginal tooth of the right mandible. This reduction looks like an adaptation to soil-feeding alternative to the commoner form in which the elongated apical tooth becomes widely spaced from the first marginal and the second marginal is reduced. The wide space between the pick-like apical and the second marginal produced by the suppression of the first marginal achieves a similar result. This feature is again found in *Anenteotermes*, and the slightly longer mesenteric overlap with the proctodeum found in Group III may be a further indication of relationship with that genus.

Other Species. Three species do not fit readily into any group. *A. impedians* sp. n. is a medium-sized species which most resembles Group I but has shorter apical teeth to the mandibles and somewhat wider meso- and metanota. The latter feature, with the long necked, rather prominently lobed enteric valve seating, suggest affinities with Group II. *A. empodius* sp. n. is closest to Group II but the strongly lobed sessile, dorsolateral enteric valve seating in the worker and narrow meso- and metanota in the imago add to a general similarity of appearance to *Adynatotermes*, which is borne out by its position in the principal co-ordinates analysis. *A. irrixosus* sp. n., like the previous species, was at first included in Group II, but its larger size, the proportions of the mandibles, the slender fore tibia of the worker and the wider imaginal meso- and metanota suggest affinities with *Astratotermes* and *Alyscotermes*. It also has the enteric valve seating dorsolateral in the worker abdomen.

Key to Species

Imagos

1 Right mandible with anterior edge of first marginal tooth at least as long as anterior edge of second marginal (where second marginal connected to posterior edge of first by a continuous curve, lowest point to be regarded as beginning of second) . 2

– Right mandible with anterior edge of first marginal distinctly shorter than anterior edge of second marginal 16

2 Pilosity of head capsule consists of short somewhat uneven pelt with very long emergent setae, many of them over 0·2 mm; those near compound eyes extending beyond outer curve of eye by nearly half their length 3

– Pilosity of head capsule shorter, emergent setae, where distinct, at most only slightly beyond curve of eye 4

3 Meso- and metanota proportionately wider at constriction, M/W, 0·31–0·32 ***ignavus*** (p. 75)

– Meso- and metanota narrower at constriction, M/W, 0·26–0·27 . . ***murcus*** (p. 79)

4 Fontanelle subject to pronounced sexual dimorphism: in ♀, large sunken pale area approximately equal in size to compound eye; in ♂ small black slit or obsolete, surrounded by dark pigmented area larger than ocellus . . . . ***acholus*** (p. 139)
– Fontanelle not so 5
5 Left mandible with apical tooth shorter in proportion to distances between marginal teeth, complex ratio $L_A/L_1.L_m$, under 6·5 (known range 4·5–5·5) 6
– Left mandible with apical tooth proportionately longer, $L_A/L_1.L_m$, over 6·5 (known range 7·5–13·2) 7
6 Meso- and metanota proportionately wider at constriction, M/W, 0·33–0·36. Left mandible with proximal end of subsidiary marginal tooth separated from molar prominence by wide notch; postclypeus more strongly inflated, Pcl/W, 0·26–0·27, with distinct median suture . . . . ***irrixosus*** (p. 100)
– Meso- and metanota narrower at constriction, M/W, 0·22–0·28. Left mandible with subsidiary marginal tooth only just clear of molar prominence, and with markedly concave cutting edge; postclypeus weakly inflated Pcl/W, 0·22–0·24, median suture indistinct or absent . . . . . . ***empodius*** (p. 94)
7 Ocelli almost touching compound eyes, separated by one-quarter or less of own least diameter . . . . ***obstructus*** (p. 88)
– Ocelli separated from compound eyes by at least one-third own least diameter . 8
8 Ocelli small and separated from eyes by more than own least diameter ***aganus*** (p. 69)
– Ocelli larger, separated from eyes by less than own least diameter 9
9 Larger, W, 0·98–1·01; meso- and metanota wider at constriction M, 0·29–0·33, N, 0·29–0·33, L_1/M.N, 1·40–1·81 10
– Smaller, W, 0·69–0·94; meso- and metanota narrower at constriction, M, 0·14–0·25, N, 0·14–0·28, L_1/M.N, 1·99–5·35 11
10 Postclypeus more inflated, apical teeth of mandibles shorter, Pcl/R_A, 3·00–3·22, L_A/L_1, 0·52–0·56 . . . . ***hapalus*** (p. 72)
– Postclypeus less inflated, apical teeth of mandibles longer, Pcl/R_A, 2·61, L_A/L_1, 0·66 ***mitis*** (p. 77)
11 Postclypeus less inflated, apical teeth of mandibles longer, Pcl/R_A, 1·93–2·00, R_A/R_1, 1·04–1·05 . . . . ***amicus*** (p. 58)
– Postclypeus more inflated, apical teeth of mandibles shorter, Pcl/R_A, 2·83–4·15, R_A/R_1, 0·65–0·89 12
12 Right mandible with second marginal tooth distinctly broader based and more robust than first, distal margin slightly convex (Text-fig. 74) . ***comis*** (p. 63)
– Right mandible with marginal teeth approximately equal or first more prominent, distal margin of second straight or slightly concave 13
13 Fore tibia with third (outer) apical spur, vestigial. Smaller, W, 0·69–0·73 ***benignus*** (p. 61)
– Fore tibia with third apical spur only slightly smaller than other two. Larger, W, 0·73–0·94 14
14 Meso- and metanota proportionately wider at constriction, apical teeth of mandibles slightly shorter, M/R_A, 3·40–3·77, L_1/M.N, 1·99–2·32. Larger, W, 0·86–0·94. Compound eyes prominent in proportion to own diameter (Text-fig. 204) ***impedians*** (p. 98)
– Meso- and metanota narrower at constriction, apical teeth slightly longer, M/R_A, 2·10–3·00, L_1/M.N, 2·69–4·13. Smaller, W, 0·73–0·86, compound eyes not prominent in proportion to own diameter 15
15 Posterior margin of head capsule evenly rounded. Smaller, W, 0·73–0·75. Left mandible, apical tooth longer, L_A/L_1, 0·69–0·79, proximal end of subsidiary marginal tooth separated from molar prominence by definite notch (Text-fig. 75) ***eumenus*** (p. 67)
– Posterior margin of head slightly unevenly rounded. Larger, W, 0·75–0·86. Left mandible, apical tooth shorter, L_A/L_1, 0·52–0·64, proximal end of subsidiary marginal tooth just clear of molar prominence (Text-fig. 73) . ***concilians*** (p. 65)

16 Posterior margin of head capsule usually evenly rounded, pilosity a short fine pelt with emergent setae. Median suture of postclypeus usually weak, sometimes absent. Transverse dark suture of mesonotum weak or absent, that of metanotum weak. (Distribution, West Africa to Uganda, and Congo) . ***quietus*** (p. 91)

– Posterior margin of head capsule usually unevenly rounded, pilosity usually uneven, but occasionally approaching a pelt. Median suture of postclypeus distinct. Transverse sutures of meso- and metanota distinct. (Distribution, S. Africa to Angola) . . . . ***brevior*** (p. 84)

Workers

1 Fore tibia with third apical spur vestigial, one-quarter or less length of other two (3rd spur sometimes hard to find) 2

– Fore tibia with third apical spur not vestigial, more than one-quarter length of other two 6

2 Small, W, 0·65–0·66. Fore tibia more inflated T_l/T_w, 4·22–4·34. Enteric valve seating dorsolateral, nearly dorsal, in unopened abdomen . ***benignus*** (p. 61)

– Larger, W, 0·85–1·08. Fore tibia less inflated, T_l/T_w, 4·55–5·96. Enteric valve seating lateral in unopened abdomen 3

3 Apical teeth of mandibles longer, L_A/L_l, 0·79; left mandible with proximal end of subsidiary marginal tooth clear of molar prominence but not separated by deep notch, $L_A/L_l.L_m$, 15·81. Postclypeus more inflated, Pcl/R_l, 3·05. Fore tibia more inflated, T_l/T_w, 4·55. Pilosity of head capsule pale, fine and inconspicuous. Junction between mesenteron and proctodeum nearly transverse; enteric valve seat prominently bilobed, ventrolateral in unopened abdomen (Text-figs 000 & 000) . . . . ***mitis*** (p. 77)

– Apical teeth of mandibles shorter L_A/L_l, 0·62–0·73; proximal end of subsidiary marginal tooth separated by deep notch from molar prominence, $L_A/L_l.L_m$, 7·90–9·97. Postclypeus less inflated, Pcl/R_l, 2·39–2·63. Fore tibia less inflated, T_l/T_w, 5·21–5·96. Pilosity of head capsule long, yellow to yellow-brown, conspicuous. Mesenteric–proctodeal junction diagonal or longer, enteric valve seat weakly bilobed, lateral 4

4 Right mandible with anterior edge of first marginal tooth shorter than anterior edge of second . . . . ***murcus*** (p. 79)

– Right mandible with anterior edge of first marginal tooth slightly longer than anterior edge of second 5

5 Smaller, W, 0·85. Apical teeth of mandibles shorter, L_A/L_l, 0·62 ***ignavus*** (p. 75)

– Larger, W, 1·08. Apical teeth of mandibles longer, L_A/L_l, 0·73 . ***irrixosus*** (p. 100)

6 Enteric valve seating sessile on second pouch of proctodeum or at most with very short (length less than own width) neck 7

– Enteric valve seating with a definite to very long (length equal to own least width or more) neck connecting it with second pouch of proctodeum 11

7 Right mandible with anterior edge of first marginal tooth approximately equal to anterior edge of second. Enteric valve seating with three prominent lobes, inner almost equal to outer pair . . . . . ***empodius*** (p. 94)

– Right mandible with anterior edge of first marginal tooth definitely shorter than anterior edge of second. Enteric valve seating weakly lobed, inner lobe where present much smaller than outer pair 8

8 Small, W, 0·58–0·60. Proportions of mandibular teeth by complex ratios $L_A/L_l.L_m$, 14·80–18·60, $R_A/R_l.R_m$, 18·29–22·15. Fore tibia more inflated, T_l/T_w, 3·90–4·07 ***comis*** (p. 63)

– Larger, W, 0·70–0·93. Mandibular ratios, $L_A/L_l.L_m$, 7·25–12·41, $R_A/R_l.R_m$, 9·94–14·10. Fore tibia less inflated, T_l/T_m, 4·02–5·52 9

9 Enteric valve seating ventrolateral in unopened abdomen. Smaller, W, 0·70, T_l, 0·46, fore tibia more inflated, T_l/T_w, 4·02. 'Abdominal dehiscence' absent **acholus** (p. 82)

– Enteric valve seating dorsolateral in unopened abdomen. Larger, W, 0·71–0·93, T_l, 0·50–0·66, fore tibia less inflated, T_l/T_w, 4·21–5·52. 'Abdominal dehiscence' very frequent 10

10 Armature of enteric valve with a few minute spines on the proximal one-third of cushions in positions 3 and 4. (Distribution, South Africa to Angola) **brevior** (p. 84)

– Enteric valve cushions scaly, without spines. (Distribution, W. Africa to Uganda, and Congo) . . . . **quietus** (p. 91)

11 Larger, W, 0·88–0·91 12

– Smaller, W, 0·64–0·77 13

12 Enteric valve seating with two prominent lobes only, lateral in unopened abdomen. Mesenteric-proctodeal junction diagonal . . . . . . **hapalus** (p. 72)

– Enteric valve seating with three prominent lobes, third almost equal, ventrolateral in unopened abdomen. Mesenteric-proctodeal junction nearly transverse **aganus** (p. 69)

13 Right mandible with anterior edge of first marginal tooth distinctly shorter than anterior edge of second . . . . **obstructus** (p. 88)

– Right mandible with anterior edge of first marginal approximately equal to second . 14

14 Fore tibia more inflated, T_l/T_w, 3·86–3·88. Apical teeth of mandibles longer, L_A/L_l, 0·69–0·86, R_A/R_l, 0·97–1·00 15

– Fore tibia less inflated, T_l/T_w, 4·22–4·47. Apical teeth of mandibles shorter, L_A/L_l, 0·54–0·67. R_A/R_l, 0·72–0·92 16

15 Larger, W, 0·77, T_l, 0·61. Left mandible with subsidiary marginal tooth just clear of molar prominence. Complex ratio $R_A/T_w.L_l$, 4·46 . . **amicus** (p. 58)

– Smaller, W, 0·64, T_l, 0·43. Left mandible with subsidiary marginal tooth separated from molar prominence by deep notch. Complex ratio $R_A/T_w.L_l$, 7·20 **eumenus** (p. 67)

16 Apical teeth of mandibles proportionately shorter, L_A/L_l, 0·54; left mandible with subsidiary marginal tooth separated from molar prominence by deep notch, $L_A/L_l.L_m$, 12·45. (Distribution, Zambia) . . . . . **impedians** (p. 98)

– Apical teeth proportionately longer, L_A/L_l, 0·59–0·67; left mandible with subsidiary marginal tooth just clear of molar prominence, $L_A/L_l.L_m$, 15·65–17·79. (Distribution, West Africa) . . . . **concilians** (p. 65)

Group I

Astalotermes amicus sp. n.

(Text-figs 57, 58, 67, 68 & 77–82; Pl. 1, fig. 4)

Imago. Head capsule brown, not darker above ocelli; fontanelle small, about one-third size of ocellus, roughly circular with small depression in middle, pale yellow-brown; medial spot roughly circular, flat or slightly raised, little smaller than fontanelle, yellow-brown; postclypeus yellow-brown, labrum yellow; frontal marks flat, almost obsolete, weak crescents, yellow-brown; antennae yellow. Pronotum, meso- and metanota yellow-brown, transverse sutures present but weak; legs, femora yellow, tibiae pale yellow, tarsi yellow-white. Abdominal tergites yellow-brown, sternites, dorsal and ventral stigmata pale yellow-brown, cerci pale yellow.

Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by half own least diameter or slightly more; postclypeus moderately inflated, Pcl/W, 0·25–0·26, Pcl/R_A, 1·93–2·00, posterior margin evenly rounded, median suture very weak. Apical teeth of mandibles rather long, L_A/L_l, 0·71–0·79, R_A/R_l, 1·04–1·05; subsidiary

marginal tooth of left mandible with proximal end just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 11·61–13·20; points of apical and marginal teeth of right mandible in line, anterior edges of marginal teeth approximately equal. Pilosity of head capsule yellow, slightly uneven, nearly a rough pelt with emergent setae. Fore tibia with third spur distinct.

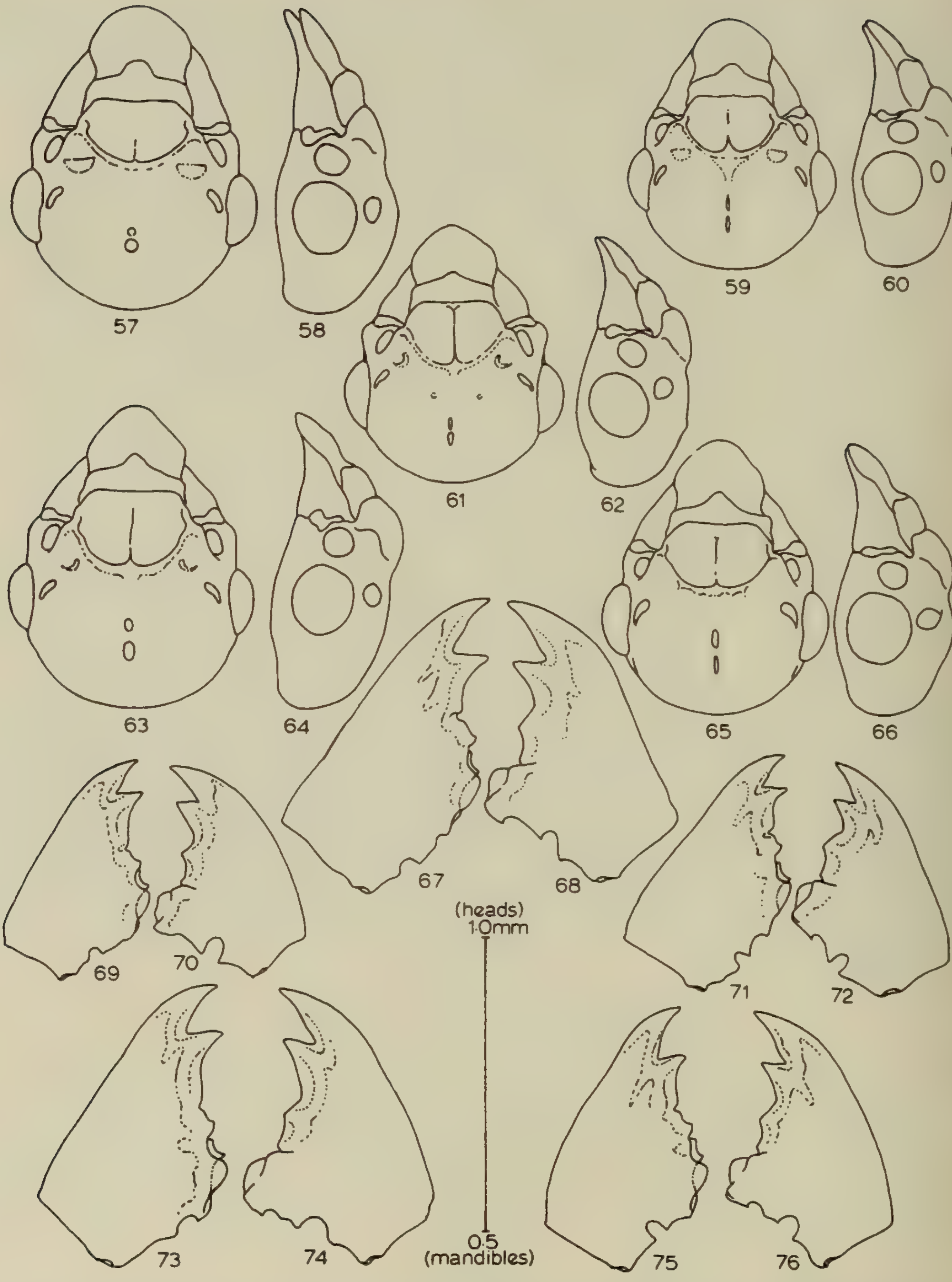
Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W) . .	0·80–0·82
Ocellus ($O_w \times O_l$) . . .	0·07 × 0·09
Ocellus to eye (O–E) . . .	0·03–0·04
Postclypeus length (Pcl) . .	0·20–0·21
Antennal article III . . .	0·03–0·04
Antennal article IV . . .	0·04–0·05
Antennal article V . . .	0·04–0·06
Left mandible, apical to first marginal (L_A)	0·09–0·10
Left mandible, first to third marginal (L_1)	0·13
Left mandible, third marginal to molar (L_m)	0·06
Right mandible, apical to first marginal (R_A)	0·10–0·11
Right mandible, first to second marginal (R_1)	0·10
Right mandible, second marginal to molar (R_m) . . .	0·06
Mesonotum width (M) . . .	0·16–0·23
Metanotum width (N) . . .	0·15–0·23

Worker. Head capsule pale yellow, pilosity similarly coloured, very fine, silky and sparse. Postclypeus rather weakly inflated, Pcl/W, 0·24, Pcl/R_1, 2·10. Apical teeth of mandibles rather long, L_A/L_1, 0·69, R_A/R_1, 0·97; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 14·45; first marginal tooth of right mandible slightly behind line of apical to second marginal, but anterior edge equal to that of second, $R_A/R_1.R_m$, 20·99. Fore tibia moderately inflated, T_l/T_w, 3·86, third apical spur distinct. Mesenteric junction with proctodeum diagonal, to right of malpighian knot; enteric valve seating lateral in unopened abdomen, two lobes moderately developed, connected to second pouch by proctodeum by long neck, membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (one specimen) in millimetres.

Head width (W)	0·77
Fore tibia width (T_w)	0·16
Fore tibia length (T_l)	0·61
Postclypeus length (Pcl)	0·18
Left mandible, apical to first marginal (L_A)	0·08
Left mandible, first to third marginal (L_1) .	0·12
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A)	0·09
Right mandible, first to second marginal (R_1)	0·09
Right mandible, second marginal to molar (R_m)	0·05



FIGS 57–76. *Astalotermes*, imago head capsules, front and side views, and imago mandibles. 57, 58 & 67, 68, *A. amicus*; 59, 60 & 69, 70, *A. benignus*; 61, 62 & 71, 72, *A. comis*; 63, 64 & 73, 74, *A. concilians*; 65, 66 & 75, 76, *A. eumenus*.

This species is separable from its nearest relations, *A. comis* sp. n., *A. concilians* (Silvestri) and *A. eumenus* sp. n. in the imago by its weakly inflated postclypeus and longer apical teeth of the mandibles. The worker is larger than *A. comis* and *A. eumenus*, with differently proportioned mandibles, and in *A. concilians* the fore tibia is less inflated and the apical teeth shorter. The abdomen of the worker caste does not appear to be dehiscent in *A. amicus*.

Holotype ♀ imago, paratype ♀ and ♂ imagos, and workers from type-colony, TANZANIA: Amani, 21.iv.1950 (*P. B. Kemp* Coll. No. 384), in British Museum (Natural History).

Only the type nest-series of this species is known.

There is no information on its biology.

Astalotermes benignus sp. n.

(Text-figs 59, 60, 69, 70 & 83–88; Pl. 1, fig. 3)

[*Anoplotermes lateralis* (Walker); Silvestri, 1914 : 65. Misidentification.]

Imago. Head capsule dark sepia-brown, very dark above ocelli; fontanelle small, brown, elongate oval, weakly ridged in middle, running forwards into groove through medial spot; medial spot sepia-brown, oval, slightly ridged on each side of groove that continues forward into depressed triangular area behind postclypeus; postclypeus sepia-brown, labrum yellow-brown; frontal marks brown, semicircular, distinct, very slightly depressed; antennae brown. Pronotum, meso- and metanota sepia-brown, transverse dark sutures present; legs, femora and tibiae yellow-brown, tarsi yellow. Abdominal tergites brown, with sepia-brown stigmata, sternites pale brown with brown stigmata; cerci pale brown.

Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by two-fifths to two-thirds own least diameter; postclypeus moderately inflated, Pcl/W, 0·26–0·30, Pcl/R_A, 3·06–3·63, posterior margin evenly rounded, median suture weak, absent anteriorly. Apical teeth of mandibles short, L_A/L_1, 0·50–0·57, R_A/R_1, 0·71–0·82; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, $L_A/L_1.L_m$, 11·13–12·40; points of apical and marginal teeth of right mandible in line, anterior edges of marginal teeth equal. Pilosity of head capsule yellow-brown, very uneven, no pelt. Fore tibia with vestigial third spur sometimes extremely difficult to find.

Measurements (three specimens from two localities) in millimetres.

	Range	Mean
Head width across eyes (W) .	0·69–0·73	0·705
Ocellus ($O_w \times O_l$) . . .	0·05–0·06 × 0·07–0·08	0·055 × 0·077
Ocellus to eye (O–E) . .	0·02–0·03	0·030
Postclypeus length (Pcl) .	0·19–0·21	0·195
Antennal article III . .	0·03	—
Antennal article IV . .	0·03–0·04	0·033
Antennal article V . .	0·03–0·04	0·033
Left mandible, apical to first marginal (L_A)	0·06	—
Left mandible, first to third marginal (L_1)	0·10–0·11	0·107
Left mandible, third marginal to molar (L_m)	0·04–0·05	0·046

Right mandible, apical to first marginal (R_A) . . .	0·06	—
Right mandible, first to second marginal (R_l) . . .	0·08	—
Right mandible, second marginal to molar (R_m) . .	0·05	—
Mesonotum width (M) . .	0·15–0·18	0·165
Metanotum width (N) . .	0·14–0·19	0·166

Worker. Head capsule yellow, pilosity orange-yellow, numerous and rather coarse, short. Postclypeus rather strongly inflated, Pcl/W, 0·29–0·30, Pcl/R_l, 2·35–2·55. Apical teeth of mandibles fairly short, L_A/L_l, 0·58–0·61, R_A/R_l, 0·71–0·80; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, $L_A/L_l.L_m$, 15·19–16·50; apical and marginal teeth of right mandible approximately in line, anterior edges of marginal teeth equal, $R_A/R_l.R_m$, 19·00–19·39. Fore tibia weakly inflated, T_l/T_w, 4·22–4·34, third apical spur vestigial. Mesenteric junction with proctodeum slightly longer than diagonal, to right of malpighian knot; enteric valve seating dorsolateral in unopened abdomen, weakly two-lobed, connected to second pouch of proctodeum by short neck, membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (two specimens from two localities) in millimetres.

Head width (W) . . .	0·65–0·66
Fore tibia width (T_w) . . .	0·10
Fore tibia length (T_l) . . .	0·43–0·44
Postclypeus length (Pcl) . .	0·19
Left mandible, apical to first marginal (L_A)	0·06
Left mandible, first to third marginal (L_l)	0·10
Left mandible, third marginal to molar (L_m)	0·04
Right mandible, apical to first marginal (R_A)	0·06
Right mandible, first to second marginal (R_l)	0·08
Right mandible, second marginal to molar (R_m)	0·04

The vestigial third apical spur of the fore tibia distinguishes this small species from its closest relatives, *A. concilians* in particular since it is sympatric. The other species with a vestigial spur are much larger in Group II, and *A. benignus* is in any case unique in the genus in having the spur reduced to this extent in both castes. It also differs from *A. amicus* and *A. eumenus*, and *A. comis* in the proportions of the mandibular teeth. The abdomen of the worker is definitely dehiscent in *A. benignus*.

Holotype ♀ imago, paratype ♀ and ♂ imagos, and workers from type-colony, GUINEA: Mt. Nimba, Pierré Richaud, 10.viii.1951 (*M. Lamotte* coll. No. 18 Pa.392), in American Museum of Natural History (paratype ♀ and worker from type-colony also in BMNH).

Other paratype material. GUINEA: Mamou, 10°20'N., 12°15'W., 25.viii.1912

(*F. Silvestri*), in Silvestri Coll., Ist. Ent. Agr. Portici, and AMNH. IVORY COAST: Mt. Nimba, 26.xii.1968 (*G. Josens*), in his own collection and BMNH.

The existing records provide no information on the biology of this species.

Astalotermes comis sp. n.

(Text-figs 61, 62, 71, 72 & 89–94)

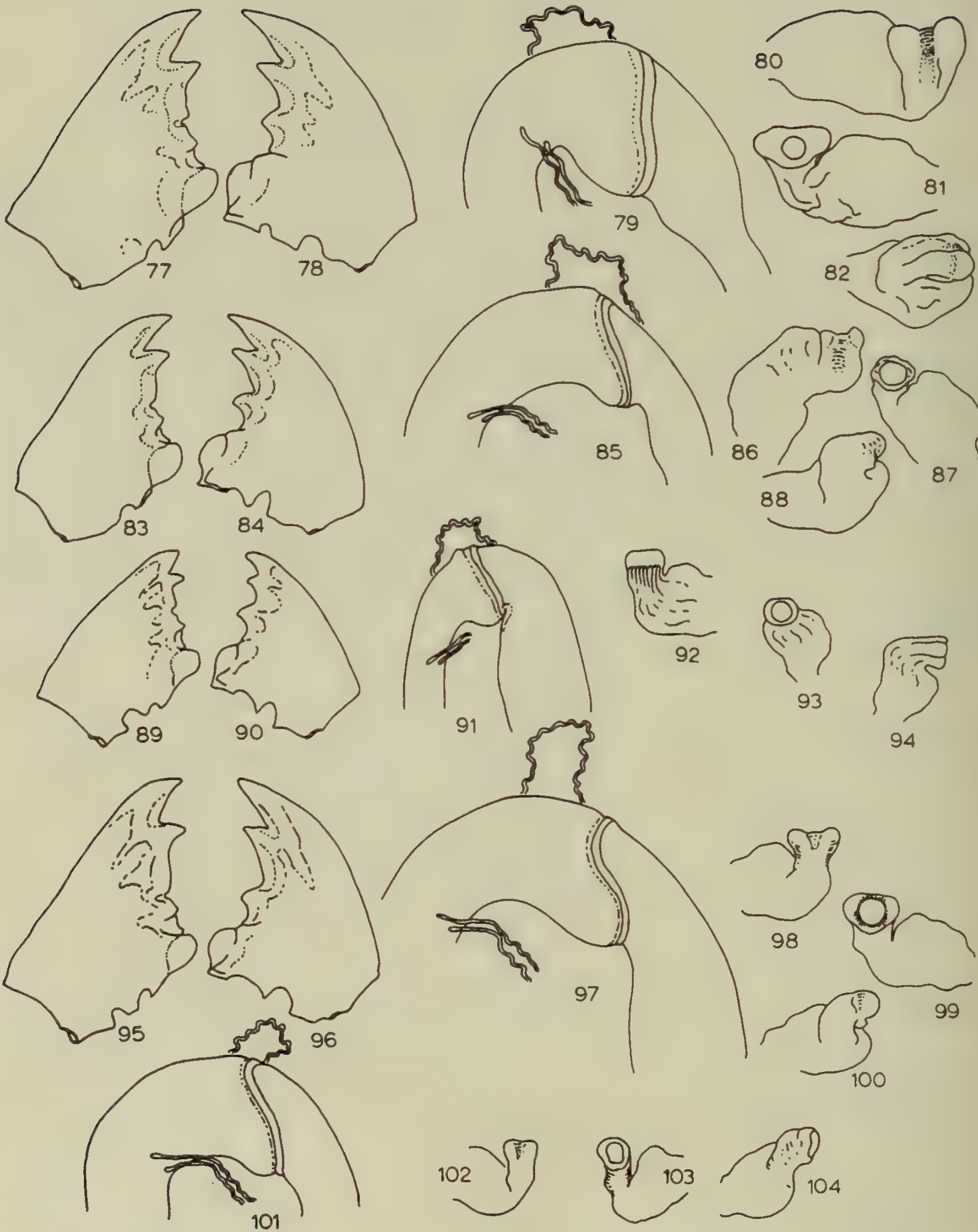
Imago. Head capsule sepia-brown, dark sepia-brown above ocelli, dark areas usually extending as tapering streaks converging to fontanelle; fontanelle small, oval, flat, indistinct, coloured as head; medial spot elongate oval, about as large as fontanelle, also coloured as head; postclypeus brown, labrum pale brown; frontal marks weak flat crescents, brown; antennae, pale brown. Pronotum brown, meso- and metanota pale brown, transverse dark suture weak on meso-, distinct on metanotum; legs, femora and tibiae pale brown, tarsi yellow-white. Abdominal tergites and lateral parts of sternites pale brown, middle of sternites yellow-white, stigmata as sclerites; cerci yellow-white.

Posterior margin of head capsule not quite evenly rounded, slightly undulating, ocelli medium-sized, separated from compound eyes by from two-fifths to three-quarters own least diameter; postclypeus moderately inflated, Pcl/W, 0·27–0·31, Pcl/R_A, 3·21–4·15, posterior margin evenly rounded, median suture distinct. Apical teeth of mandibles short, L_A/L_1, 0·51–0·63, R_A/R_1, 0·65–0·82; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, $L_A/L_1.L_m$, 8·66–10·91; point of right first marginal tooth slightly behind line from apical to second marginal, and its anterior edge slightly shorter than that of broadly based second. Pilosity of head capsule brown, dense, uneven, no pelt. Fore tibia with well developed third apical spur.

Measurements (nine specimens from five localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	0·69–0·81	0·736 ± 0·040
Ocellus ($O_w \times O_l$) . .	0·06–0·08 × 0·08–0·10	0·064 ± 0·005 × 0·085 ± 0·010
Ocellus to eye (O–E) .	0·03–0·05	0·039 ± 0·006
Postclypeus length (Pcl) .	0·19–0·25	0·210 ± 0·002
Antennal article III . .	0·02–0·03	0·019 ± 0·003
Antennal article IV .	0·02–0·04	0·028 ± 0·006
Antennal article V . .	0·02–0·04	0·027 ± 0·005
Left mandible, apical to first marginal (L_A) .	0·05–0·07	0·053 ± 0·007
Left mandible, first to third marginal (L_1) . .	0·09–0·11	0·095 ± 0·008
Left mandible, third marginal to molar (L_m) .	0·05–0·06	0·057 ± 0·003
Right mandible, apical to first marginal (R_A) .	0·05–0·07	0·057 ± 0·008
Right mandible, first to second marginal (R_1) .	0·07–0·09	0·078 ± 0·006
Right mandible, second marginal to molar (R_m) .	0·05–0·06	0·052 ± 0·004
Mesonotum width (M) .	0·14–0·20	0·163 ± 0·020
Metanotum width (N) .	0·14–0·21	0·162 ± 0·027

Worker. Head capsule yellow-white, pilosity same colour, very sparse, fine, and short. Postclypeus strongly inflated, Pcl/W, 0·32–0·35, Pcl/R_1, 3·04–3·95. Apical teeth of mandibles fairly short, L_A/L_1, 0·56–0·61, R_A/R_1, 0·69–0·80; subsidiary marginal tooth of left mandible



FIGS 77–104. *Astalotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seatings. 77–82, *A. amicus*; 83–88, *A. benignus*; 89–94, *A. comis*; 95–100, *A. concilians*; 101–104, *A. eumenus*.

just clear of molar prominence in surface view, $L_A/L_1.L_m$, 14·8–18·6; point of right first marginal tooth slightly behind line from apical to second marginal, and its anterior edge distinctly shorter than that of broadly-based second, $R_A/R_1.R_m$, 18·29–22·15. Fore tibia moderately inflated, T_l/T_w, 3·90–4·07, third apical spur prominent. Mesenteric junction with proctodeum almost transverse, coinciding with malpighian knot; enteric valve seating lateral in unopened abdomen, very weakly two-lobed, almost a rim, sessile on second pouch of proctodeum, membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (four specimens from three localities) in millimetres.

	Range	Mean
Head width (W)	0·58–0·60	0·585
Fore tibia width (T_w)	0·10–0·11	0·105
Fore tibia length (T_l)	0·41–0·43	0·422
Postclypeus length (Pcl)	0·18–0·20	0·192
Left mandible, apical to first marginal (L_A)	0·04–0·05	0·045
Left mandible, first to third marginal (L_1)	—	0·077
Left mandible, third marginal to molar (L_m)	0·03–0·04	0·034
Right mandible, apical to first marginal (R_A)	0·04–0·05	0·043
Right mandible, first to second marginal (R_1)	0·05–0·06	0·056
Right mandible, second marginal to molar (R_m)	—	0·038

A. comis is distinguishable from near relations such as *A. amicus*, *A. concilians* and *A. eumenus* in both castes by the broadly based second marginal and smaller first marginal of the right mandible. Differences from *A. benignus* and *Acidnotermes praus* are given under those species, and its relationship to the latter has already been discussed. The reduced right first marginal tooth in the worker perhaps also indicates a trend towards the Group III species. However, the proportions of the mandibles are actually different, as indicated by the complex ratios, and the mesenteric junction with the proctodeum is shorter. A further feature is that the worker abdomen appears non-dehiscent in *A. comis*.

Holotype ♀ imago, paratype ♀ and ♂ imagos, and workers from type-colony, REPUBLIC OF SOUTH AFRICA: Natal, Ubombo, 18.xi.1955 (*W. G. H. Coaton*) in National Collection of Isoptera, No. TM. 1413, Pretoria. (Paratype ♀ and ♂ imagos, and workers from type-colony also in British Museum (Natural History).)

Other paratype material. REPUBLIC OF SOUTH AFRICA: Natal, Ubombo, 18, 19, 21.xi.1955, six vials, Ingwavuma, 23.xi.1955, two vials, Transvaal, Waterberg, 3.x.1960 (*W. G. H. Coaton*) in N.C.I., Pretoria and BMNH.

A total of 10 nest-series have been examined, but no information is available on the biology of this species.

Astalotermes concilians (Silvestri) **comb. n.**

(Text-figs 63, 64, 73, 74 & 95–100)

Anoplotermes concilians Silvestri, 1914 : 59. LECTOTYPE ♀, GUINEA: Kindia (Silvestri Coll., Istituto di Entomologia Agraria, Naples), here designated [examined].

Anoplotermes placidus Silvestri, 1914 : 63. LECTOTYPE ♂, GUINEA: Mamou (Silvestri Coll., Istituto di Entomologia Agraria, Naples), here designated [examined]. **Syn. n.**

Imago. Head capsule brown to sepia-brown, very dark above ocelli; fontanelle small, yellow-brown to pale brown, short oval, slightly depressed; medial spot short oval, flat or slightly

raised, coloured as head; postclypeus yellow-brown to sepia-brown, not darker than head capsule, labrum pale yellow-brown to pale brown; frontal marks smooth, pale, flat, crescents, yellow-brown to brown; antennae pale yellow-brown. Pronotum, meso- and metanota, yellow-brown to brown, transverse dark sutures weak on meso- and metanota; legs, femora pale yellow-brown to pale brown, tibiae paler, tarsi yellow-white to yellow. Abdominal tergites and lateral parts of sternites brown, proximal three sternites paler in middle, dorsal stigmata sometimes paler than tergites, ventral stigmata pale brown; cerci yellow-white.

Posterior margin of head capsule not quite evenly rounded, slightly undulating; ocelli medium-sized, separated from compound eyes by from two-fifths to two-thirds own least diameter; postclypeus moderately to strongly inflated, Pcl/W, 0·27–0·36, Pcl/R_A, 2·83–3·43, posterior margin evenly rounded, median suture distinct. Apical teeth of mandibles short L_A/L_l, 0·52–0·64, R_A/R_l, 0·71–0·88; subsidiary marginal tooth of left mandible clear of molar prominence in surface view, $L_A/L_l.L_m$, 8·51–12·53; points of apical and marginal teeth of right mandible approximately in line, anterior edges of marginal teeth equal or first slightly longer than second. Pilosity of head capsule pale yellow to yellow, uneven, no pelt. Fore tibia with well developed third apical spur.

Measurements (eight specimens from six localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	0·75–0·86	0·812 ± 0·039
Ocellus ($O_w \times O_l$)	0·06–0·08 × 0·08–0·10	0·066 ± 0·006 × 0·089 ± 0·005
Ocellus to eye (O–E)	0·03–0·04	0·035 ± 0·004
Postclypeus length (Pcl)	0·21–0·28	0·255 ± 0·026
Antennal article III	0·02–0·04	0·030 ± 0·007
Antennal article IV	0·04–0·05	0·043 ± 0·003
Antennal article V	0·04–0·05	0·044 ± 0·005
Left mandible, apical to first marginal (L_A)	0·07–0·09	0·079 ± 0·006
Left mandible, first to third marginal (L_l)	0·12–0·15	0·136 ± 0·009
Left mandible, third marginal to molar (L_m)	0·05–0·06	0·055 ± 0·005
Right mandible, apical to first marginal (R_A)	0·07–0·09	0·082 ± 0·006
Right mandible, first to second marginal (R_l)	0·09–0·12	0·104 ± 0·011
Right mandible, second marginal to molar (R_m)	0·05–0·06	0·055 ± 0·004
Mesonotum width (M)	0·19–0·23	0·203 ± 0·015
Metanotum width (N)	0·18–0·22	0·201 ± 0·013

Worker. Head capsule yellow-white, pilosity yellow, rather long but sparsely scattered. Postclypeus moderately to strongly inflated, Pcl/W, 0·25–0·35, Pcl/R_l, 1·69–3·00. Apical teeth of mandibles fairly short to rather longer, L_A/L_l, 0·59–0·67, R_A/R_l, 0·72–0·92; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_l.L_m$, 15·65–17·79; first marginal tooth of right mandible very slightly behind line of apical to second marginal, anterior edge of first marginal approximately equal to that of second, at most only very slightly shorter, $R_A/R_l.R_m$, 16·50–21·00. Fore tibia rather weakly inflated, T_l/T_w, 4·22–4·46, third apical spur prominent, only slightly less than other two. Mesenteric junction with proctodeum diagonal, sinuate, to right of malpighian knot, distal end of mesenteron slightly swollen; enteric valve seating lateral in unopened abdomen, clearly two-lobed with sometimes a trace of third, inner lobe, connected to second pouch of proctodeum by distinct neck, membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (three specimens from three localities) in millimetres.

	Range	Mean
Head width (W)	0·66–0·71	0·692
Fore tibia width (T_w)	0·10–0·11	0·107
Fore tibia length (T_l)	0·45–0·48	0·463
Postclypeus length (Pcl)	0·17–0·24	0·196
Left mandible, apical to first marginal (L_A)	0·07–0·08	0·073
Left mandible, first to third marginal (L_l)	0·11–0·13	0·118
Left mandible, third marginal to molar (L_m)	—	0·038
Right mandible, apical to first marginal (R_A)	0·07–0·08	0·073
Right mandible, first to second marginal (R_l)	0·08–0·10	0·090
Right mandible, second marginal to molar (R_m)	0·04–0·05	0·044

The differences between *A. concilians* and *A. amicus*, *A. benignus* and *A. comis* have already been given under those species. Within Group I there only remains *A. eumenus*. This species is very similar, though slightly smaller, with somewhat longer apical teeth to the mandibles in both imago and worker castes; the latter has also a more inflated fore tibia. The abdomen of the worker is definitely dehiscent in *A. concilians*.

Lectotypes have been designated from the existing syntype material of *A. concilians* (Silvestri) and *A. placidus* (Silvestri) as indicated below.

Type-material. *Anoplotermes concilians* Silvestri, LECTOTYPE ♀ imago, paralectotype ♀ imagos and workers from type-colony, GUINEA: Kindia, 10°N., 12°45'W., 21.viii.1912 (*F. Silvestri*), in Silvestri Coll., Istituto di Entomologia Agraria, Portici, Naples. *Anoplotermes placidus* Silvestri, LECTOTYPE ♂ imago, paralectotype ♀ (teneral) and ♂ imagos and workers from type-colony, GUINEA: Mamou, 10°20'N., 12°15'W., 25.viii.1912 (*F. Silvestri*), in Silvestri Coll., Istituto di Entomologia Agraria, Portici, Naples.

Other material. NIGERIA: Eastern Region; Port Harcourt, 5.iii.1957 (*W. Wilkinson*). Northern Region; 18 m. from Gombe on Numan Road, and 40 m. S.E. of Gombe on Numan Road, 11.v.1957, 20 m. from Yandev on Makurdi Road, 25.ii.1958, two vials (*W. A. Sands*). Apart from the type-series, material is in the BMNH.

A total of seven nest-series have been examined. Those for which the information is available suggest that this species is commonly found in the nests or mounds of other termites.

Astalotermes eumenus **sp. n.**

(Text-figs 65, 66, 75, 76 & 101–104)

Imago. Colour probably faded during long preservation of only known nest-series. Head capsule yellow-brown, not darker above ocelli; fontanelle oval, flat, vestigial, slightly paler than head; medial spot similar in size and shape to fontanelle, colour as head; postclypeus pale yellow-brown, labrum yellow; frontal marks indistinct flat crescents coloured as head; antennae yellow. Pronotum, meso- and metanota pale yellow-brown, transverse sutures absent from meso- and metanota; legs, femora yellow, tibiae and tarsi paler. Abdominal tergites and dorsal stigmata pale yellow-brown. Sternites and ventral stigmata paler still, cerci yellow.

Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by less than two-fifths own least diameter; postclypeus moderately inflated, Pcl/W, 0·30–0·31, Pcl/R_A, 2·90, posterior margin evenly rounded, median suture present but not strong. Apical teeth of mandibles rather long, L_A/L_1, 0·69–0·79, R_A/R_1, 0·85–0·89; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio $L_A/L_1.L_m$, 11·00–12·60; point of right first marginal tooth slightly behind line from apical to second marginal, but anterior edges of marginal teeth equal. Pilosity of head capsule yellow-brown, dense and uneven, no pelt. Fore tibia with third apical spur only slightly smaller than other two.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W) .	0·73–0·75
Ocellus ($O_w \times O_l$) . .	0·06–0·07 × 0·09
Ocellus to eye (O–E) . .	0·03
Postclypeus length (Pcl) .	0·23
Antennal article III . .	0·03
Antennal article IV . .	0·04
Antennal article V . .	0·04
Left mandible, apical to first marginal (L_A) . . .	0·08
Left mandible, first to third marginal (L_1) . . .	0·10–0·11
Left mandible, third marginal to molar (L_m) . . .	0·06
Right mandible, apical to first marginal (R_A) . . .	0·08
Right mandible, first to second marginal (R_1) .	0·09
Right mandible, second marginal to molar (R_m) . .	0·06
Mesonotum width (M) . .	0·16–0·17
Metanotum width (N) . .	0·16

Worker. Head capsule and its pilosity yellow, the latter very sparse. Postclypeus strongly inflated, Pcl/W, 0·35, Pcl/R_1, 3·21; apical teeth of mandibles long, L_A/L_1, 0·86, R_A/R_1, 1·00; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio $L_A/L_1.L_m$, 17·08; first marginal tooth of right mandible slightly behind line of apical to second marginal, but anterior edge equal to that of second, $R_A/R_1.R_m$, 22·15. Fore tibia moderately inflated, T_l/T_w, 3·88, third apical spur pale and about half length of other two. Mesenteric junction with proctodeum diagonal, slightly sinuate, just to right of malpighian knot; enteric valve seating very weakly two-lobed, almost a rim, connected to second pouch of proctodeum by a definite neck, probably lateral in position in unopened abdomen; membranous wall of valve beyond cushions with minute spicules.

Measurements (one specimen) in millimetres.

Head width (W)	0·64
Fore tibia width (T_w)	0·11
Fore tibia length (T_l)	0·43
Postclypeus length (Pcl) . . .	0·23
Left mandible, apical to first marginal (L_A)	0·08
Left mandible, first to third marginal (L_1) .	0·09
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A)	0·07

Right mandible, first to second marginal (R_1)	0·07
Right mandible, second marginal to molar (R_m)	0·05

A. eumenus has been compared with the other members of species Group I under their own descriptions and thus no further comment on *A. amicus*, *A. benignus*, *A. comis* and *A. concilians* will be made. Its position in relation to other members of the genus has also been discussed. Whether or not the worker abdomen is dehiscent is uncertain in *A. eumenus*.

Holotype ♀ imago, paratype ♀ and ♂ imagos, and worker from type-colony, DEMOCRATIC REPUBLIC OF CONGO: Mukimbungu, 5°S., 14°E., ix.1909 (*K. E. Laman*), in American Museum of Natural History. Paratype ♀ and ♂ imago from type-colony also in BMNH.

Only the type nest-series is known. There is no information on its biology.

Group II

Astalotermes aganus sp. n.

(Text-figs 106, 107, 116, 117 & 126–131)

Imago. Head capsule dark sepia-brown, slightly darker above ocelli; fontanelle distinct, pale brown to brown, broad oval or nearly circular, distinctly depressed and roughened with irregular transverse striations, only slightly smaller than ocelli; medial spot oval, brown to sepia-brown, flat, slightly smaller than fontanelle; postclypeus sepia brown, labrum pale yellow-brown; frontal marks distinct, semicircular, slightly to distinctly depressed, sepia-brown; antennae, brown. Pronotum sepia-brown, meso- and metanota brown, transverse dark sutures present in both; legs, femora brown, tibiae pale brown, tarsi yellow-white. Abdominal tergites brown, dorsal stigmata sepia-brown, sternites brown, very pale in middle, ventral stigmata brown; cerci pale brown.

Posterior margin of head capsule evenly rounded; ocelli rather small, separated from compound eyes by up to one-third more than own least diameter; postclypeus moderately inflated, Pcl/W, 0·25–0·26, Pcl/R_A, 2·71–2·75, posterior margin evenly rounded, median suture distinct. Apical teeth of mandibles fairly short, L_A/L_1, 0·65–0·66, R_A/R_1, 0·89–0·91; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio $L_A/L_1.L_m$, 7·47–8·83; points of apical and marginal teeth of right mandible in line, anterior edge of first marginal distinctly longer than that of second. Pilosity of head capsule pale brown, uneven, no pelt. Meso- and metanota somewhat wider at constriction, M/W, 0·27–0·32. Fore tibia with third apical spur distinct.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W) . .	1·06–1·14
Ocellus ($O_w \times O_l$) . . .	0·08 × 0·10
Ocellus to eye (O–E) . . .	0·09–0·10
Postclypeus length (Pcl) . .	0·28–0·29
Antennal article III . . .	0·03–0·04
Antennal article IV . . .	0·05–0·06
Antennal article V . . .	0·05–0·06
Left mandible, apical to first marginal (L_A)	0·10–0·11

Left mandible, first to third marginal (L_1)	0·16
Left mandible, third marginal to molar (L_m)	0·08–0·09
Right mandible, apical to first marginal (R_A)	0·10–0·11
Right mandible, first to second marginal (R_1)	0·11–0·12
Right mandible, second marginal to molar (R_m)	0·08
Mesonotum width (M)	0·29–0·36
Metanotum width (N)	0·31–0·38

Worker. Head capsule yellow-white, pilosity pale yellow, very sparse and fine. Postclypeus moderately inflated, Pcl/W, 0·27, Pcl/R_1, 3·08; apical teeth of mandibles moderately long, L_A/L_1, 0·75, R_A/R_1, 1·08; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio $L_A/L_1.L_m$, 14·95; apical and marginal teeth of right mandible approximately in line, anterior margins of first and second marginals equal, $R_A/R_1.R_m$, 19·10. Fore tibia scarcely inflated, T_1/T_w, 4·52, third apical spur distinct though smaller than other two. Mesenteric junction with proctodeum almost transverse, to right of malpighian knot; enteric valve seating ventrolateral in unopened abdomen, prominently three-lobed, third lobe almost equal in size to outer two, connected to second pouch of proctodeum by moderately long neck; membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (one specimen) in millimetres.

Head width (W)	0·91
Fore tibia width (T_w)	0·14
Fore tibia length (T_1)	0·65
Postclypeus length (Pcl)	0·25
Left mandible, apical to first marginal (L_A)	0·10
Left mandible, first to third marginal (L_1)	0·13
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A)	0·09
Right mandible, first to second marginal (R_1)	0·08
Right mandible, second marginal to molar (R_m)	0·06

The *Astalotermes* species of Group II are not so clearly separable from other genera as Group I. *A. aganus* is based on a single nest-series which was at first included in *A. empodius* sp. n. It differs in the proportions of the mandibles, particularly the subsidiary marginal tooth of the left, and in the imago in having smaller ocelli further from the compound eyes; in addition the meso- and metanota are wider at the constriction. In the worker caste, the gut of *A. aganus* is shorter, the enteric valve seating being nearly ventral, and necked, instead of dorsolateral and nearly sessile as in *A. empodius*, which also has a very small third apical spur on the fore tibia. The differences in the proportions of the ocelli and mandibles were sharply pointed up by the principal component scores and the wide separation of the species

in the canonical variates analysis. In the principal component analysis, the transformation vectors corresponding to the second and third latent roots gave the clearest separation. These respectively were composed mainly of a contrast between ocellus size and mandibular tooth length, and a contrast between mandibles and antennal segment lengths. The same characters in different combinations received the largest weightings in the first three imago canonical variates. Apart from the complex ratios already adopted throughout this work as a result of the multivariate analyses, one further is therefore helpful in the present discussion: $O_{l}.O_{w}/L_{A}.R_{A}$, *A. aganus*, 0·66–0·72, *A. empodius*, 1·25–1·85.

Of the other members of Group II, *A. ignavus* sp. n. and *A. murcus* sp. n. are distinguished by the very long head setae of the imago, the much shorter postclypeus, and ocelli closer to the compound eyes. In the worker caste, the vestigial third apical spur of the more slender fore tibia and the two-lobed seating of the enteric valve separate these species from *A. aganus*. The same features of the worker, apart from the thickness of the fore tibia, also distinguish *A. mitis* which is rather similar to *A. aganus* in the imago, though with ocelli closer to the eye, and a less evenly rounded posterior margin to the postclypeus. *A. hapalus* resembles *A. mitis* in both castes except that the worker fore tibia has a longer third apical spur, the mandibles have shorter apical teeth, and the postclypeus is longer in the imago. The last two species mentioned appear to be most closely related to *A. aganus* and one another. In the imago of *A. aganus* the fontanelle provides a useful 'spot' character by which it is quickly separated from sympatric members of other genera. *Alyscotermes kilimandjaricus* (Sjöstedt), *Adynatotermes moretelae* (Fuller), *Agano-*

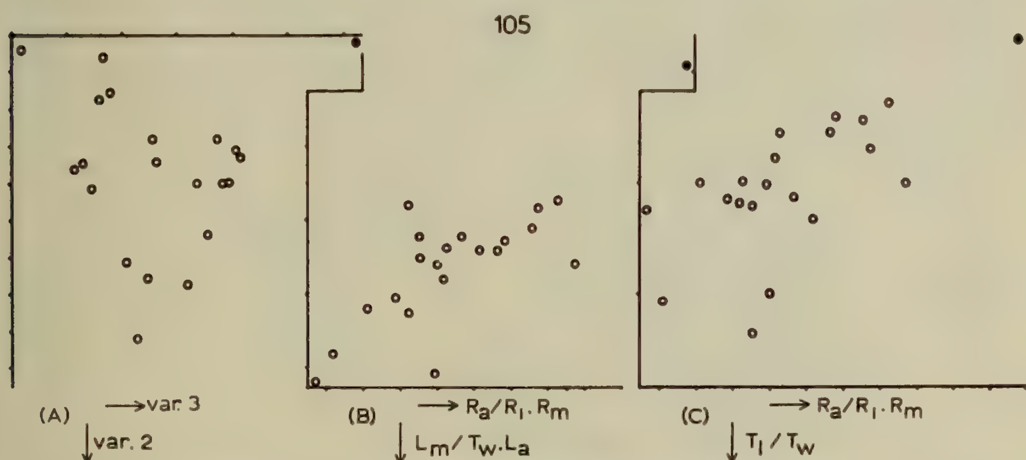


FIG. 105. *Astalotermes hapalus* (solid dot) recognized by computer as distinct in worker caste from *Alyscotermes kilimandjaricus* (rings) after misidentification. (A) Plot of principal component scores (transformed variables) corresponding to latent roots 2 & 3 of correlation matrix. (B) & (C) Plots of discriminant ratios derived from examination of weighting coefficients on original variables provided by eigenvectors of correlation matrix.

termes oryctes sp. n. are all about the same size, and though many other differences are used in keys and descriptions, the fontanelle is easily observed. It is not however a character that can be used more widely since it only differs in degree of development from some congeners mentioned above. Whether or not the worker abdomen is dehiscent is uncertain in *A. aganus*.

Holotype ♀ imago, paratype ♀ and ♂ imagos and workers from type-colony, REPUBLIC OF SOUTH AFRICA: Natal, Mahlabatini, 6.xii.1959 (*P. C. Joubert*) in National Collection of Isoptera, No. TM.6995, Pretoria. (Paratype ♀ and ♂ imagos, and workers from type-colony also in BMNH.)

No biological information is available about the single known nest-series.

Astalotermes hapalus **sp. n.**

(Text-figs 105, 108, 109, 118, 119 & 132–137)

Imago. Head capsule chestnut-brown, not darker above ocelli, fontanelle less than half as long as ocellus, oval, flat or slightly raised, pale yellow-brown; medial spot nearly circular, flat, same size as fontanelle, brown; postclypeus brown, labrum yellow-brown; frontal marks distinct, crescent-shaped, slightly depressed, pale brown; antennae yellow-brown. Pronotum brown, meso- and metanota brown, transverse dark sutures present in both, stronger in metanotum; legs, femora brown, tibiae yellow-brown, tarsi yellow. Abdominal tergites brown, dorsal stigmata pale brown, sternites pale brown, pale yellow in middle, ventral stigmata pale brown; cerci pale yellow.

Posterior margin of head capsule evenly rounded; ocelli rather small, separated from compound eyes by more than own least diameter; postclypeus moderately inflated, Pcl/W, 0·29, Pcl/R_A, 3·00–3·22, posterior margin evenly rounded, median suture distinct. Apical teeth of mandibles short, L_A/L_1, 0·52–0·56, R_A/R_1, 0·75–0·83; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio, $L_A/L_1.L_m$, 7·70–9·10; points of apical and marginal teeth of right mandible in line, anterior edge of first marginal distinctly longer than that of second. Pilosity of head capsule brown, uneven, no pelt. Meso- and metanota somewhat wider at constriction, M/W, 0·29–0·31. Fore tibia with third apical spur distinct.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W)	0·98–1·01
Ocellus ($O_w \times O_l$)	0·08–0·09 × 0·10–0·13
Ocellus to eye (O–E)	0·07
Postclypeus length (Pcl)	0·28–0·29
Antennal article III	0·04–0·05
Antennal article IV	0·05–0·06
Antennal article V	0·06
Left mandible, apical to first marginal (L_A)	0·08
Left mandible, first to third marginal (L_1)	0·15–0·16
Left mandible, third marginal to molar (L_m)	0·06–0·07
Right mandible, apical to first marginal (R_A)	0·09
Right mandible, first to second marginal (R_1)	0·11–0·13

FIGS 106–115. *Astalotermes*, imago head capsules, front and side views. 106, 107, *A. aganus*; 108, 109, *A. hapalus*; 110, 111, *A. ignavus*; 112, 113, *A. mitis*; 114, 115, *A. murcus*.

Right mandible, second marginal to molar (R_m) . . .	0·06–0·07
Mesonotum width (M) . .	0·29–0·31
Metanotum width (N) . .	0·29–0·33

Worker. Head capsule pale yellow, pilosity yellow, very sparse and inconspicuous. Postclypeus strongly inflated, Pcl/W, 0·33, Pcl/R_l, 3·01; apical teeth of mandibles moderately long, L_A/L_l, 0·72, R_A/R_l, 1·00; subsidiary tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio, $L_A/L_l.L_m$, 14·41; first marginal tooth of right mandible slightly behind line of apical to second marginal, $R_A/R_l.R_m$, 18·20. Fore tibia scarcely inflated, T_l/T_w, 4·73, third apical spur distinct, about one-third size of other two. Mesenteric junction with proctodeum diagonal, to right of malpighian knot; enteric valve seating lateral in unopened abdomen, prominently two-lobed, connected to second pouch of proctodeum by moderately long neck; membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (one specimen) in millimetres.

Head width (W)	0·88
Fore tibia width (T_w)	0·14
Fore tibia length (T_l)	0·65
Postclypeus length (Pcl) . . .	0·27
Left mandible, apical to first marginal (L_A)	0·09
Left mandible, first to third marginal (L_l) .	0·13
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A).	0·09
Right mandible, first to second marginal (R_l)	0·09
Right mandible, second marginal to molar (R_m)	0·06

This species was originally confused with *Alyscotermes kilimandjaricus* (Sjöstedt). It was first recognized in the principal component analysis as an anomalous outlying point at some distance from the cloud represented by the numerous specimens of the latter. This is illustrated in Text-fig. 105, and compared with similar graphs derived from complex ratios. These incorporate most of the variation comprised in the latent roots corresponding to the principal component scores as illustrated, and provide the best discrimination between the two species based on measurements.

A. hapalus has been compared to *A. aganus* and *A. mitis* under the former species heading. *A. ignavus* and *A. murcus* are distinguishable from *A. hapalus* in the imago by their head pilosity, in which very long setae emerge from a shorter pelt, their larger fontanelle, and less inflated postclypeus. The workers of those two species have vestigial third apical spurs on their very slender fore tibiae. Whether or not the abdomen is dehiscent is unknown.

Holotype ♀ imago, paratype ♀ and ♂ imagos and workers from type-colony, KENYA: Ngong Hills (near Nairobi), N.W. end, 16.vi.1953 (*W. A. Sands* collection No. S497) in British Museum (Natural History).

Only the type-series is known. The small colony was found under a loose rock.

Astalotermes ignavus sp. n.

(Text-figs 110, 111, 120, 121 & 138–143; Pl. 1, fig. 5)

Imago. Head capsule chestnut-brown, very dark above ocelli; fontanelle nearly as large as ocellus, elongate oval, flat or slightly depressed, brown; medial spot oval, flat, distinctly smaller than fontanelle, chestnut-brown; postclypeus brown, labrum yellow-brown, frontal marks flat, shining, semi-circular, brown; antennae yellow-brown. Pronotum and mesonotum brown, metanotum yellow-brown, transverse, dark sutures weakly present in meso- and metanota; legs, femora pale yellow-brown, tibiae yellow, tarsi pale yellow. Abdominal tergites brown, dorsal stigmata sepia-brown, sternites yellow-brown, paler in middle, ventral stigmata brown, cerci, pale yellow-brown.

Posterior margin of head capsule not quite evenly rounded, slightly undulating immediately behind eyes; ocelli rather small, separated from compound eyes by slightly less than own least diameter; postclypeus weakly inflated, Pcl/W, 0·21, Pcl/R_A, 2·48–2·67, posterior margin obtusely angular, not rounded, median suture distinct. Apical teeth of mandibles short, L_A/L_1, 0·58–0·59, R_A/R_1, 0·77–0·84, subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio $L_A/L_1.L_m$, 6·74–6·81; points of apical and marginal tooth of right mandible in line, anterior edge of first marginal distinctly longer than that of second. Pilosity of head capsule brown, very long emergent setae with rough pelt of shorter setae beneath; longest setae reach well beyond outer curve of compound eyes. Meso- and metanota somewhat wider at constriction, M/W, 0·31–0·32. Fore tibia with third apical spur distinct.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W) .	1·04–1·11
Ocellus ($O_w \times O_l$) . . .	0·08–0·09 × 0·11–0·12
Ocellus to eye (O–E) . .	0·07–0·08
Postclypeus length (Pcl) . .	0·22–0·23
Antennal article III . . .	0·03–0·04
Antennal article IV . . .	0·04–0·06
Antennal article V . . .	0·03–0·06
Left mandible, apical to first marginal (L_A) . . .	0·09
Left mandible, first to third marginal (L_1) . . .	0·14–0·16
Left mandible, third marginal to molar (L_m)	0·09
Right mandible, apical to first marginal (R_A) . . .	0·08–0·09
Right mandible, first to second marginal (R_1) . . .	0·11
Right mandible, second marginal to molar (R_m) . . .	0·09
Mesonotum width (M) . .	0·30–0·32
Metanotum width (N) . .	0·28–0·34

Worker. Head capsule and pilosity pale yellow-brown, the latter long and conspicuous. Postclypeus moderately inflated, Pcl/W, 0·26, Pcl/R_1, 2·49, apical teeth of mandibles short L_A/L_1, 0·62, R_A/R_1, 0·89; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio $L_A/L_1.L_m$, 9·97; apical and marginal teeth of right mandible approximately in line, anterior margin of first marginal slightly longer than that of second, $R_A/R_1.R_m$, 14·20. Fore tibia scarcely inflated, T_l/T_w, 5·21, third apical spur vestigial or absent. Mesenteric junction with proctodeum diagonal, touching malpighian knot on right; enteric valve seating lateral in unopened abdomen, weakly bilobed, connected

FIGS 116–125. *Astalotermes*, imago mandibles. 116, 117, *A. aganus*; 118, 119, *A. hapalus*; 120, 121, *A. ignavus*; 122, 123, *A. mitis*; 124, 125, *A. murcus*.

to second pouch of proctodeum by distinct neck; membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (one specimen) in millimetres.

Head width (W)	0·85
Fore tibia width (T_w)	0·12
Fore tibia length (T_l)	0·63
Postclypeus length (Pcl)	0·22
Left mandible, apical to first marginal (L_A)	0·08
Left mandible, first to third marginal (L_1)	0·13
Left mandible, third marginal to molar (L_m)	0·06
Right mandible, apical to first marginal (R_A)	0·08
Right mandible, first to second marginal (R_1)	0·09
Right mandible, second marginal to molar (R_m)	0·06

This species, with *A. murcus*, is characterized by the very long head setae of the imago which separate these two from the rest of Group II. *A. murcus* differs from *A. ignavus* in having a slightly more evenly rounded head capsule and narrower meso- and metanota. The worker of *A. murcus* has the first marginal tooth of the right mandible somewhat reduced compared with that of *A. ignavus*. The vestigial third spur of the worker fore tibia distinguishes these two species from others of Group II apart from *A. mitis*, but this has a thicker fore tibia, more inflated postclypeus, and longer apical teeth to the mandibles. *A. irrixosus* which also has a vestigial third tibial spur is much larger, with longer apical teeth, and a very wide notch separating the subsidiary marginal tooth of the left mandible from its molar prominence. Other comparative details are given in the discussion of species already described. One in four specimens of the worker caste of *A. ignavus* shows abdominal dehiscence.

Holotype queen, paratype king and workers from type-colony, CONGO (BRAZZAVILLE): 13 km W. of Brazzaville, 8.vi.1948 (*A. E. Emerson*) in American Museum of Natural History. (Paratype second queen and workers from type-colony, also in BMNH.)

The only known nest-series was collected at the base of a dead stump in an open field.

Astalotermes mitis **sp. n.**

(Text-figs 112, 113, 122, 123 & 144–149)

Imago. Head capsule sepia-brown, not darker above ocelli; fontanelle small, less than half as long as ocellus, very short oval, somewhat depressed in middle with slight transverse striations, pale yellow-brown; medial spot circular, flat, smaller than fontanelle, sepia-brown; postclypeus brown, labrum yellow-brown; frontal marks flat, crescent-shaped, brown; antennae yellow-brown, pronotum brown, meso- and metanota, yellow-brown; only the latter with transverse dark suture; legs, femora yellow-brown, tibiae paler, tarsi yellow. Abdominal tergites and

dorsal stigmata yellow-brown, sternites and ventral stigmata pale yellow-brown, sternites yellow in middle; cerci yellow.

Posterior margin of head capsule evenly rounded, ocelli medium-sized, separated from compound eyes by slightly less than own least diameter; postclypeus rather weakly inflated, Pcl/W, 0·25, Pcl/R_A, 2·61, posterior margin undulating, not evenly rounded, median suture distinct. Apical teeth of mandibles fairly short, L_A/L_1, 0·66, R_A/R_1, 0·86; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 10·55; points of apical and marginal teeth of right mandible in line, anterior edges of marginal teeth almost equal, first slightly longer. Pilosity of head capsule yellow-brown, uneven, no pelt. Meso- and metanota somewhat wider at constriction, M/W, 0·32. Fore tibia with third apical spur distinct.

Measurements (one specimen) in millimetres.

Head width across eyes (W)	1·01
Ocellus ($O_w \times O_l$)	0·08 × 0·11
Ocellus to eye (O–E)	0·07
Postclypeus length (Pcl)	0·25
Antennal article III	0·04
Antennal article IV	0·04
Antennal article V	0·05
Left mandible, apical to first marginal (L_A)	0·09
Left mandible, first to third marginal (L_1)	0·14
Left mandible, third marginal to molar (L_m)	0·06
Right mandible, apical to first marginal (R_A)	0·10
Right mandible, first to second marginal (R_1)	0·11
Right mandible, second marginal to molar (R_m)	0·06
Mesonotum width (M)	0·33
Metanotum width (N)	0·31

Worker. Head capsule yellow-white, pilosity pale yellow, sparse and fine. Postclypeus rather strongly inflated, Pcl/W, 0·33, Pcl/R_1, 3·05; apical teeth of mandibles rather long, L_A/L_1, 0·79, R_A/R_1, 1·07; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 15·81; first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edges of marginal teeth about equal, $R_A/R_1.R_m$, 21·01. Fore tibia scarcely inflated, T_l/T_w, 4·55, third apical spur vestigial, almost obsolete. Mesenteric junction with proctodeum almost transverse slightly slanted, to right of malpighian knot; enteric valve seating lateral or slightly ventrolateral in unopened abdomen, rather prominently two-lobed, connected to second pouch of proctodeum by long neck, membranous wall of valve beyond cushions without detectable spicules.

Measurements (one specimen) in millimetres:

Head width (W)	0·87
Fore tibia width (T_w)	0·14
Fore tibia length (T_l)	0·63
Postclypeus length (Pcl)	0·28
Left mandible, apical to first marginal (L_A)	0·10
Left mandible, first to third marginal (L_1)	0·13
Left mandible, third marginal to molar (L_m)	0·05

Right mandible, apical to first marginal (R_A)	0·10
Right mandible, first to second marginal (R_l)	0·09
Right mandible, second marginal to molar (R_m)	0·05

Most of the comparisons between *A. mitis* and other species of Group II have already been made in the preceding descriptions. It is distinguishable from Group III species mainly by the mandible and intestinal characters of the worker caste, and by the vestigial third apical spur of the fore tibia. *A. irrixosus* is larger and has the subsidiary marginal tooth of the left mandible widely separated from the molar prominence. *A. empodius* has narrower meso- and metanota in the imago, and shorter apical teeth to the mandibles. In the worker it is distinguished from *A. mitis* by the almost dorsal, sessile, three-lobed enteric valve seating and the distinct third apical spur of the fore tibiae. The abdomen of the worker of *A. mitis* is definitely dehiscent.

Holotype queen and paratype workers from type-colony, MALAWI: Zomba Mountain, altitude 5,800 ft, 1956 (*A. W. R. MacCrae*) in British Museum (Natural History).

No biological information is available about the single known nest-series.

Astalotermes murcus sp. n.

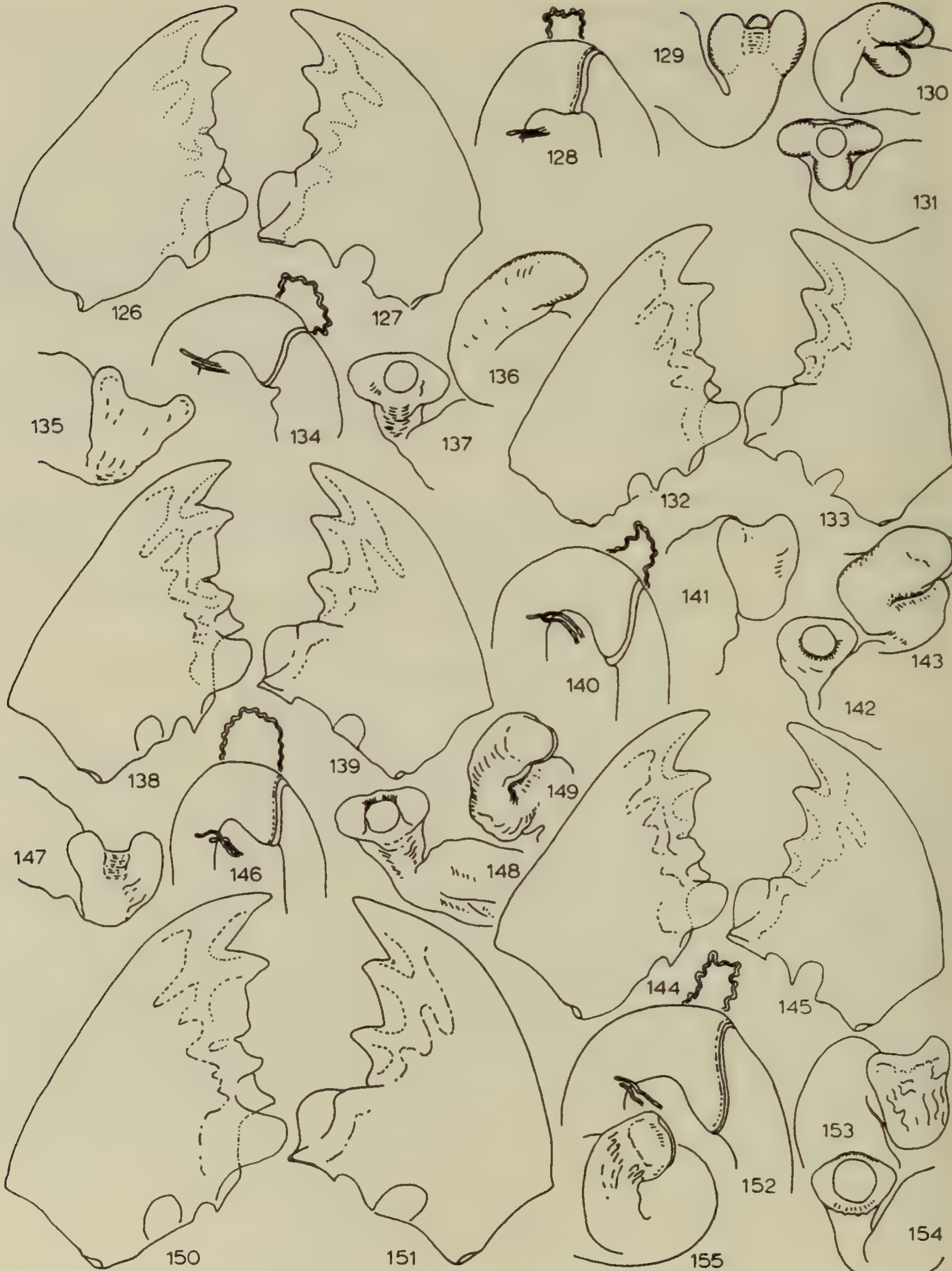
(Text-figs 114, 115, 124, 125 & 150–155)

Imago. Head capsule chestnut-brown, darker above ocelli; fontanelle oval, outline indistinct about half as large as ocellus, flat or slightly depressed, colour as head capsule; medial spot circular, flat, slightly smaller than fontanelle, same colour; postclypeus chestnut-brown, labrum yellow-brown; frontal marks flat, very indistinct crescents, coloured as head; antennae brown. Pronotum chestnut-brown, meso- and metanota brown, transverse sutures weak or absent; legs, femora and tibiae yellow-brown, tarsi pale yellow. Abdominal tergites brown, dorsal stigmata sepia-brown; sternites yellow-brown, yellow in middle, ventral stigmata brown; cerci pale brown.

Posterior margin of head capsule evenly rounded; ocelli rather small, separated from compound eyes by slightly less to slightly more than own least diameter; postclypeus weakly inflated, Pcl/W, 0·19–0·21, Pcl/R_A, 2·33–2·53, posterior margin broadly rounded or slightly angular, median suture very weak. Apical teeth of mandibles short, L_A/L_1, 0·55–0·59, R_A/R_1, 0·83; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio $L_A/L_1.L_m$, 6·60–6·81; points of apical and marginal teeth of right mandible in line, anterior edge of first marginal distinctly longer than that of second. Pilosity of head capsule brown, very long emergent setae with definite pelt of shorter setae beneath; longest setae reach well beyond outer curve of compound eyes. Meso- and metanota rather narrower at constriction, M/W, 0·26–0·27. Fore tibia with third apical spur distinct.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W) . . .	1·11–1·23
Ocellus ($O_w \times O_l$) . . .	0·08 × 0·10
Ocellus to eye (O–E) . . .	0·07–0·08
Postclypeus length (Pcl) . .	0·21–0·26
Antennal article III . . .	0·03–0·05



FIGS 126–155. *Astalotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seatings. 126–131, *A. aganus*; 132–137, *A. hapalus*; 138–143, *A. ignavus*; 144–149, *A. mitis*; 150–155, *A. murcus*.

Antennal article IV	0·06–0·08
Antennal article V	0·06–0·07
Left mandible, apical to first marginal (L_A)	0·09–0·10
Left mandible, first to third marginal (L_l)	0·16–0·18
Left mandible, third marginal to molar (L_m)	0·08–0·09
Right mandible, apical to first marginal (R_A)	0·09–0·10
Right mandible, first to second marginal (R_l)	0·11–0·13
Right mandible, second marginal to molar (R_m)	0·09
Mesonotum width (M)	0·30–0·32
Metanotum width (N)	0·28–0·34

Worker. Head capsule pale yellow, pilosity yellow, long, numerous and conspicuous. Postclypeus moderately inflated, Pcl/W, 0·30, Pcl/R_l, 2·63; apical teeth of mandibles short, L_A/L_l, 0·64, R_A/R_l, 0·85; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio $L_A/L_l.L_m$, 7·90; first marginal tooth of right mandible slightly behind line of apical to second marginal, its anterior margin distinctly shorter than that of second, $R_A/R_l.R_m$, 10·46. Fore tibia slender, T_l/T_w, 5·80, third apical spur vestigial. Mesenteric junction with proctodeum diagonal, touching malpighian knot on right; enteric valve seating lateral in unopened abdomen, weakly bilobed, connected to second pouch of proctodeum by long neck; membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (one specimen) in millimetres.

Head width (W)	1·03
Fore tibia width (T_w)	0·14
Fore tibia length (T_l)	0·81
Postclypeus length (Pcl)	0·31
Left mandible, apical to first marginal (L_A)	0·10
Left mandible, first to third marginal (L_l)	0·16
Left mandible, third marginal to molar (L_m)	0·08
Right mandible, apical to first marginal (R_A)	0·10
Right mandible, first to second marginal (R_l)	0·12
Right mandible, second marginal to molar (R_m)	0·08

Comparisons of *A. murcus* with Group II species have been made in the preceding descriptions. Its very close similarity to *A. ignavus* gave rise to some uncertainty as to whether these two should be described separately or considered one species. However, the two records are from over 1,000 miles apart. The differences in the proportions of the mandibles, and the meso- and metanotal constrictions are such as are found between species or even genera that are clearly separated by other characters; they are also found within a single variable species. The decision to split them in the absence of intermediate specimens was taken on the principle that this will cause less confusion in the long run than the converse should either

prove to be wrong. *A. irrixosus* is closer in size to this species than to *A. ignavus*, but it has a more inflated postclypeus and shorter head pilosity in the imago, and the proportions of the worker mandibles are different. *A. empodius* is again distinguished by differing mandibles in both imago and worker, also in the imago by the shorter pilosity and the worker by the very different enteric valve seating. The worker abdomen does not appear to be dehiscent.

Holotype ♀ imago, paratype ♀ and ♂ imagos, and workers from type-colony, ZAMBIA: Ndola, 30.i.1957 (*W. G. H. Coaton*) in National Collection of Isoptera, No. TM 4110, Pretoria.

Other paratype material. ZAMBIA: Kitwe, 23.i.1957 (*W. G. H. Coaton*) in N.C.I. coll. No. TM 3920, Pretoria.

No biological information is available about this species.

Group III

Astalotermes acholus sp. n.

(Text-figs 156–159, 170, 171 & 178–183; Pl. 1, fig. 6)

Imago. Head capsule dark sepia-brown, very dark above ocelli; fontanelle subject to pronounced sexual dimorphism, in ♀, large sunken pale brown area approximating in size to compound eye, surface slightly irregular; in ♂, small pitch-black elongate oval, slightly raised, or obsolete, in either case surrounded by very dark sepia-brown flat area larger than ocellus; medial spot circular, flat, minute, sepia-brown; postclypeus pale brown to brown, labrum yellow; frontal marks very indistinct brown crescents, slightly depressed at inner ends; antennae brown. Pronotum sepia-brown, meso- and metanota brown, transverse sutures very weak; legs, femora pale yellow-brown, tibiae yellow, tarsi pale yellow; abdominal tergites and dorsal stigmata sepia-brown, ventral stigmata and sternites brown, the latter paler in middle; cerci pale yellow.

Posterior margin of head capsule slightly undulating, not evenly rounded; ocelli fairly large, separated from compound eyes by less than half own least diameter; postclypeus weakly inflated, Pcl/W, 0·21–0·22, Pcl/R_A, 2·23–2·51, posterior margin bowed, median suture absent. Apical teeth of mandibles short, L_A/L_1, 0·52–0·64, R_A/R_1, 0·64–0·76; subsidiary marginal tooth of left mandible well clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 6·79–8·09; first marginal tooth of right mandible slightly behind line of apical to second marginal, its anterior margin slightly longer than that of second. Pilosity of head capsule yellow-brown, uneven, no pelt. Meso- and metanota narrow at constriction, M/W, 0·23–0·25. Fore tibia with third apical spur shorter but distinct.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W)	0·85–0·92
Ocellus ($O_w \times O_l$)	0·08 × 0·11–0·12
Ocellus to eye (O–E)	0·03–0·04
Postclypeus length (Pcl)	0·19–0·20
Antennal article III	0·03–0·04
Antennal article IV	0·04–0·05
Antennal article V	0·04–0·05
Left mandible, apical to first marginal (L_A)	0·07–0·09
Left mandible, first to third marginal (L_1)	0·14

Left mandible, third marginal to molar (L_m)	0·08
Right mandible, apical to first marginal (R_A)	0·07–0·09
Right mandible, first to second marginal (R_1)	0·12
Right mandible, second marginal to molar (R_m)	0·06
Mesonotum width (M) . . .	0·19–0·23
Metanotum width (N) . . .	0·22–0·25

Worker. Head capsule pale yellow, pilosity yellow, fairly sparse. Postclypeus moderately inflated, Pcl/W, 0·27, Pcl/R_1, 1·85; apical teeth of mandibles short, L_A/L_1, 0·51, R_A/R_1, 0·61; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 10·32; first marginal tooth of right mandible distinctly behind line of apical to second, its anterior margin approximately half length of second, $R_A/R_1.R_m$, 12·71. Fore tibia weakly inflated, T_1/T_w, 4·02, third apical spur distinct, slightly shorter than other two. Mesenteric junction with proctodeum nearly diagonal, midway through malpighian knot; enteric valve seating ventrolateral in unopened abdomen, weakly three-lobed, third lobe smaller than outer two, sessile on second pouch of proctodeum or with very short neck; membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (one specimen) in millimetres:

Head width (W)	0·70
Fore tibia width (T_w)	0·12
Fore tibia length (T_1)	0·46
Postclypeus length (Pcl) . . .	0·19
Left mandible, apical to first marginal (L_A)	0·06
Left mandible, first to third marginal (L_1) .	0·12
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A).	0·06
Right mandible, first to second marginal (R_1)	0·10
Right mandible, second marginal to molar (R_m)	0·05

Although first in alphabetic order in Group III, *A. acholus* is an aberrant species easily distinguished from all others in the imago by the widely sexually dimorphic fontanelle which is extremely conspicuous, particularly in the ♀. In the worker caste the much reduced first marginal tooth characterizes Group III and *A. acholus* is distinguished from *A. brevior*, *A. obstructus* and *A. quietus* in having the enteric valve seating ventrolateral in the unopened abdomen, together with minor features given in the key. The worker abdomen does not appear to be dehiscent.

Holotype ♀ imago, paratype ♀ and ♂ imagos, and workers from type-colony, DEMOCRATIC REPUBLIC OF CONGO: Mbamba (Bas Congo), 6.x.1966 (*C. Nkakala*) in Musée Royal de l'Afrique Centrale, Tervuren. (Paratypes from type-colony, ♀ and ♂ imagos and workers, in British Museum (Natural History) and at University of Lovanium, Kinshasa.)

There is no biological information about the single nest-series.

Astalotermes brevior (Holmgren) comb. et stat. n.

(Text-figs 160–162, 172, 173 & 184–189; Pl. 1, fig. 7)

Mirotermes (*Cubitermes*) *natalensis* form *brevior* Holmgren, 1913 : 357. Syntypes, REPUBLIC OF SOUTH AFRICA: Natal, Zululand, Mkosi (♂ in American Museum of Natural History [examined]; others, sex unknown, in Mus. Göteborg).

Anoplotermes sanctus Silvestri, 1914 : 57. LECTOTYPE ♀, ANGOLA: São Paulo de Loanda (Silvestri Coll., Istituto di Entomologia Agraria, Naples), here designated [examined]. **Syn. n.**

Mirotermes (*Procubitermes*) *mbazwanicus* Fuller, 1925 : 189. LECTOTYPE ♀, REPUBLIC OF SOUTH AFRICA: Natal, Zululand, Mbaswane Swamp (National Collection of Isoptera, Pretoria), here designated [examined]. **Syn. n.**

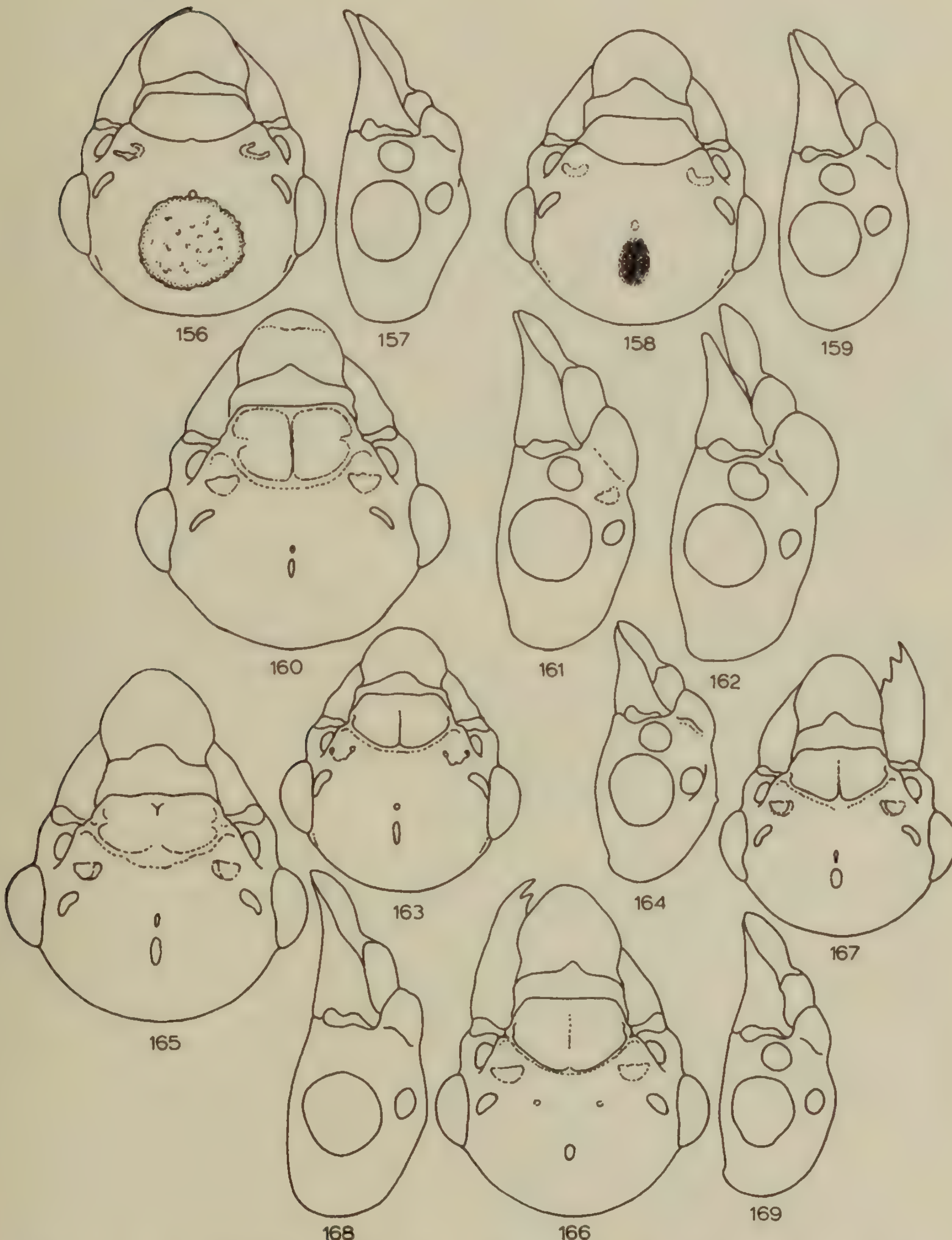
Mirotermes (*?Procubitermes*) *mfolozii* form *warreni* Fuller, 1925 : 191. LECTOTYPE ♀, REPUBLIC OF SOUTH AFRICA: Natal, Mont aux Sources (National Collection of Isoptera, Pretoria), here designated [examined]. **Syn. n.**

Imago. Head capsule very dark sepia-brown, pitch-black around ocelli and compound eyes; fontanelle variable, from broad oval only slightly smaller than ocelli, brown, and paler than head, to small, elongate oval, coloured as head, and from slightly raised to depressed or with median groove; commonest form depressed elongate oval about half size of ocellus slightly paler than head; medial spot short oval, flat, dark sepia-brown; postclypeus dark sepia-brown, labrum sepia-brown with hyaline tip; frontal marks distinct, semi-circular, depressed, sepia-brown; antennae sepia-brown. Pronotum, meso- and metanota, dark sepia-brown, transverse dark sutures of meso- and metanota very distinct; legs, sepia-brown apart from pale yellow tarsi. Abdominal tergites and sternites sepia-brown, dorsal stigmata darker, sternites paler in mid-line, ventral stigmata slightly darker; cerci brown.

Posterior margin of head capsule undulating, not evenly rounded, ocelli medium-sized, distance from compound eyes varies from just one-half own least diameter up to distinctly more than own least diameter; postclypeus rather weakly to moderately inflated, Pcl/W, 0·23–0·27; Pcl/R_A, 2·74–3·73, posterior margin evenly rounded, median suture usually distinct, always present. Apical teeth of mandibles short, L_A/L_1, 0·41–0·56, R_A/R_1, 0·59–0·79; subsidiary marginal tooth of left mandible just clear of molar prominence on surface view, complex ratio, $L_A/L_1.L_m$, 6·07–10·00; first marginal tooth of right mandible slightly behind line of apical to second marginal, its anterior margin distinctly shorter than that of second. Pilosity of head capsule generally uneven, no pelt, some specimens slightly more even, sepia-brown. Meso- and metanota less narrow at constriction, M/W, 0·25–0·31. Fore tibia with third apical spur shorter but distinct.

Measurements (30 specimens from 19 localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	0·86–1·20	1·043 ± 0·086
Ocellus ($O_w \times O_l$) . .	0·06–0·10 × 0·10–0·13	0·080 ± 0·009 × 0·109 ± 0·008
Ocellus to eye (O–E) .	0·04–0·09	0·066 ± 0·011
Postclypeus length (Pcl) .	0·23–0·31	0·262 ± 0·024
Antennal article III . .	0·02–0·04	0·032 ± 0·006
Antennal article IV .	0·03–0·06	0·044 ± 0·007
Antennal article V . .	0·04–0·06	0·046 ± 0·007
Left mandible, apical to first marginal (L_A) .	0·06–0·10	0·081 ± 0·011
Left mandible, first to third marginal (L_1) . .	0·13–0·19	0·159 ± 0·016
Left mandible, third marginal to molar (L_m) .	0·05–0·08	0·069 ± 0·009



FIGS 156–169. *Astalotermes*, imago head capsules, front and side views. 156–159, *A. acholus* showing sexual dimorphism of fontanelle; 160–162, *A. brevior*, side views show variation of postclypeus; 163, 164, *A. obstructus*; 165–169, *A. quietus*, variation in form.

Right mandible, apical to first marginal (R_A) .	0·06–0·10	0·082 ± 0·009
Right mandible, first to second marginal (R_1) .	0·09–0·15	0·122 ± 0·013
Right mandible, second marginal to molar (R_m) .	0·06–0·09	0·073 ± 0·008
Mesonotum width (M) .	0·24–0·35	0·290 ± 0·030
Metanotum width (N) .	0·25–0·35	0·302 ± 0·027

Worker. Head capsule yellow-white, pilosity pale yellow, sparse and inconspicuous. Postclypeus moderately to strongly inflated, Pcl/W, 0·29–0·33, Pcl/R_1, 2·59–3·08; apical teeth of mandibles short, L_A/L_1, 0·43–0·54, R_A/R_1, 0·57–0·76; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 9·38–12·41; first marginal of right mandible distinctly behind line of apical to second, its anterior margin approximately half length of second, $R_A/R_1.R_m$, 11·26–14·10. Fore tibia scarcely inflated, T_1/T_w, 4·32–5·00, third apical spur distinct, one-third to one-half length of other two. Mesenteric junction with proctodeum diagonal or slightly longer, to right of malpighian knot; enteric valve seating dorsolateral in unopened abdomen, weakly two-lobed, sometimes vestige of third lobe, sessile on second pouch of proctodeum; cushions of enteric valve in positions 3 and 4 with a few minute spines on proximal third, membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (12 specimens from 12 localities) in millimetres.

	Range	Mean ± S.D.
Head width (W)	0·75–0·93	0·846 ± 0·045
Fore tibia width (T_w)	0·12–0·14	0·134 ± 0·007
Fore tibia length (T_1)	0·51–0·66	0·622 ± 0·041
Postclypeus length (Pcl)	0·23–0·29	0·262 ± 0·015
Left mandible, apical to first marginal (L_A) . .	0·06–0·09	0·074 ± 0·009
Left mandible, first to third marginal (L_1) . .	0·11–0·15	0·133 ± 0·012
Left mandible, third marginal to molar (L_m) . .	0·04–0·06	0·050 ± 0·004
Right mandible, apical to first marginal (R_A) .	0·06–0·08	0·070 ± 0·008
Right mandible, first to second marginal (R_1) .	0·08–0·11	0·094 ± 0·010
Right mandible, second marginal to molar (R_m) .	0·05–0·07	0·060 ± 0·006

The large number of nest-series of this species available has permitted some study of the variation to be made, as indicated in the description above. This has led to its having been described from different parts of its range under two synonyms. It has been confused with other species in the imago, particularly *Alyscotermes kilimandjaricus* (Sjöstedt) with which it is partly sympatric; however the different proportions of the marginal teeth of the right mandible are diagnostic here. *A. brevior* most closely resembles *A. quietus*, the two being very hard to separate. Such differences as there are, are a matter of degree. In *A. brevior* the imago head pilosity is less even, the postclypeus has a more definite median suture, and the transverse sutures of meso- and metanota are more developed. In general also the ocellus is further from the compound eye, but there is an overlap in this character. In the worker caste there is more distinction in that the reduction of the right first marginal tooth has proceeded further in *A. quietus*, and its enteric valve cushions are completely unarmed. *A. obstructus*, the other Group III species is easily separated, having the ocelli nearly touching the eyes, in the worker by the necked enteric valve, and in both castes by its small size. The abdomen of the worker

caste is very definitely dehiscent, many individuals in most nest-series having ruptured between first and second tergites. Lectotypes of the junior synonyms *A. sanctus* and *A. mbazwanicus* have been selected and labelled and are designated below, together with that of a subspecies, *warreni*, wrongly attributed by Fuller to *A. mfolozii*, which is a synonym of *A. kilimandjaricus* (Sjöstedt).

Type-material. *Mirotermes* (*Cubitermes*) *natalensis* form *brevior* Holmgren, syntype ♂ imago, type-colony, REPUBLIC OF SOUTH AFRICA: Natal, Zululand, Mkosi, 1905 (*I. Trägårdh*), in American Museum of Natural History (other syntypes stated by Holmgren to be in Mus. Göteborg; these have not been examined and therefore no lectotype has been selected). *Anoplotermes sanctus* Silvestri, LECTOTYPE ♀ imago, with paralectotype ♀ and ♂ imagos and workers from type-colony, ANGOLA: Sao Paulo de Loanda, 22.ii.1913 (*F. Silvestri*), in Silvestri Coll., Istituto Entomologia di Agraria, Portici (other paralectotype ♂ imago in AMNH). *Mirotermes* (*Procubitermes*) *mbazwanicus* Fuller, LECTOTYPE ♀ imago, REPUBLIC OF SOUTH AFRICA: Natal, Zululand, Mbazwane swamp, 4.x.1923 (*C. Fuller*), in National Collection of Isoptera, Pretoria (paralectotype, type-colony, in AMNH; other paralectotypes, Durban, 8.ix.1920 (*C. P. Van der Merwe*), in N.C.I., Pretoria and AMNH). *Mirotermes* (*? Procubitermes*) *mfolozii* form *warreni* Fuller, LECTOTYPE ♀ imago, REPUBLIC OF SOUTH AFRICA: Natal, Mont aux Sources, iv.1919 (*E. Warren*), in National Collection of Isoptera, Pretoria.

The specimens named as *Mirotermes* (Cubitermes) *natalensis* form *brevior* by Holmgren, and *Mirotermes* (*Procubitermes*) *mbazwanicus* by Fuller were recognized by Dr A. E. Emerson as belonging to *Anoplotermes* sensu lat. It is as a result of his work that they are included here, since in Snyder (1949) they are catalogued under *Procubitermes*. They would have been omitted from this monograph had Dr Emerson not included them in a loan of type-material of *Anoplotermes* from the AMNH.

Other material. REPUBLIC OF SOUTH AFRICA: Cape Province; Port St. Johns, 26.xi.1950, Libode, 22.x.1956, Butterworth, 21.x.1956, and Elliotdale, 20.x.1957 (*W. G. H. Coaton*); Flagstaff (three vials), 12–14.x.1962, Herschel, 8.x, Maclear, Qumbu, Mt Fletcher (three vials), 10.x, Matatiele (six vials) 10–11.x, Mt Currie (two vials), Mt Ayliffe, 12.x, Lusikisiki (five vials), 13–14.x, Tsolo, 15.x, Komgha (seven vials), 21.x, East London (three vials), 22–23.x and Wodehouse (two vials), 5–6.x.1962 (*J. L. Sheasby & G. F. Pretorius*). Orange Free State; Harrismith, 21.xii.1959 (*P. C. Joubert*); Parys, 22.xii.1960 (*H. P. Nieman*); Heilbron (three vials) Kroonstad, 2.x, Lindley (two vials), Vrede, Reitz (three vials) 3.x, Smithfield, 4.x, Harrismith (five vials) 3–5.x, Senekal, Marquand, 6.x, Thaba 'Nchu, De Wetsdorp, Winberg and 7.x, Wepener, 8.x.1962 (*J. L. Sheasby & G. F. Pretorius*); Hoopstad, 25.x.1962 (*W. Mohalo*); Natal, Haviland Rail, xi.1918 (*C. Fuller*); Hlabisa (five vials), 17.xi, Ubombo, 21.xi.1955, Camperdown, 25.x, Lion's River, Newcastle (two vials), 26.x.1956 (*W. G. H. Coaton*); Pietermaritzburg, 5.x.1957 (*D. Fletcher*); Vryheid (two vials), 5.xii, Umvoti, 8.xii, Mapumulo (three vials), Kranskop 10.xii and Bergville, 20.xii.1959 (*P. C. Joubert*); Transvaal, De Wildt, 3.x.1915 and xi.1920, Pretoria, 7.x.1914, 29.x.1915, 21.x.1916 and 27.x.1917 (*C.*

Fuller); Ermelo (two vials), 17.xi.1939, Pretoria, 20.ix and 24.x.1939 and 23.ix.1957, Middelburg (eight vials), 25.x.1955 and (three vials), 28.x.1960, Bronkhorstspruit (two vials), 25.x.1955 and (13 vials), 23–24.ix.1957, Soutpansberg, 9.xii.1956, Carolina, 22.xii.1956 and 26.x.1960, Randfontein (three vials), Potchefstroom and Krugersdorp, 1.x.1956, Volksrust (two vials), 27.x.1956, Heidelburg (four vials), 14.x.1957, Warmbaths (three vials), 25.ix.1957 and 3.x.1960, Groblersdal (three vials), 26.ix.1957, Waterberg, 25.ix.1957 (two vials), 18–19.x.1959, 3.x.1960 and (seven vials), 27.ix.1961, Sibasa (two vials), 24–26.x.1959, Pietersburg (three vials), 5.x.1960, Nelspruit (five vials) 21.x.1960, Marico (two vials), 2.ix.1961 and Rustenburg (seven vials), 26.ix.1961 (*W. G. H. Coaton*); Piet Retief, 5.xi.1947 (*D. V. V. Webb*); Belfast, 27.iv.1936, and Lydenburg, 27.xi.1936 (*J. H. Grobler*); Bronkhorstspruit, 11.xi and Soutpansberg, 31.xii.1960 (*P. C. Joubert*); Lichtenburg, 5.xi.1960 (*H. P. Nieman*), Soutpansberg, 10.x.1960, Rustenburg (three vials), 4.x and Marico (two vials), 5–6.x.1961, Delmas (three vials) and Bethal (two vials), 1.x.1962 (*J. L. Sheasby & G. F. Pretorius*). SWAZILAND: Mbabane, 8.vi.1956 (*J. H. Grobler*); Piggs Peak (two vials), Mbabane, Stegi, Hlatikulu (two vials) and Mankaiama (four vials), 23–26.x.1960 (*W. G. H. Coaton & J. L. Sheasby*). SOUTH WEST AFRICA: Windhoek District, Neudamm-Steinhausen, 2.x.1965, Okavango District, 20 m. from Sakambo-Gowe, 28.iv.1967 (*W. G. H. Coaton*). RHODESIA: Matopos, 22.xi.1965 (*M. G. Bingham*). ZAMBIA: Choma, 14.i.1957 (*W. G. H. Coaton*).

Most of the above material is in the N.C.I., Pretoria, and parts of many nest-series have also been deposited in the BMNH or in the AMNH. A total of 202 nest-series have been examined including the type-material. Little biological information is available but this species has been recorded from the mounds of other genera, and under stones or prone logs. It is the commonest species in south and south-central Africa and extends through south-west Africa to the borders of the Congo, tolerating a fair range of climatic and vegetation types, most of them however relatively dry and open. The species has not been found in rain forest.

Astalotermes obstructus **sp. n.**

(Text-figs 163, 164, 174, 175 & 196–201)

Imago. Head capsule dark sepia-brown, not darker above ocelli; fontanelle elongate-oval, slightly shorter than ocelli, slightly depressed, brown; medial spot short oval, very small, raised on small bump, sepia-brown; postclypeus sepia-brown, labrum yellow-brown; frontal marks very indistinct, flat, crescent-shaped, sepia-brown; antennae brown. Pronotum sepia-brown, meso- and metanota brown, transverse dark suture only present on metanotum; legs, femora yellow-brown, tibiae paler, tarsi yellow. Abdominal tergites brown, dorsal stigmata paler, sternites and ventral stigmata pale brown, sternites yellow in middle; cerci yellow.

Posterior margin of head capsule not quite evenly rounded, slightly undulating behind eyes; ocelli fairly large, almost touching compound eyes, separated by one-quarter own least diameter or less; postclypeus weakly inflated, Pcl/W, 0·23–0·26, Pcl/R_A, 3·28–3·64, posterior margin obtusely angular, only rounded in middle, median suture distinct posteriorly, absent in front. Apical teeth of mandibles short, L_A/L_1, 0·50–0·60, R_A/R_1, 0·63–0·67; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 8·17–10·16; points of apical and marginal teeth of right mandible in line, anterior edges of first and

second marginals approximately equal. Pilosity of head capsule very dense, sepia-brown, uneven, with very strong emergent setae, no pelt. Meso- and metanota less narrow at constriction, M/W, 0·26–0·28. Fore tibia with third apical spur distinct, about half length of others.

Measurements (four specimens from three localities) in millimetres.

	Range	Mean
Head width across eyes (W)	0·76–0·81	0·780
Ocellus ($O_w \times O_l$)	0·08–0·09 × 0·09–0·11	0·078 × 0·099
Ocellus to eye (O–E)	0·01–0·02	0·017
Postclypeus length (Pcl)	0·18–0·20	0·193
Antennal article III	0·03–0·04	0·031
Antennal article IV	0·03–0·05	0·039
Antennal article V	—	0·038
Left mandible, apical to first marginal (L_A)	0·05–0·06	0·056
Left mandible, first to third marginal (L_1)	0·10–0·11	0·104
Left mandible, third marginal to molar (L_m)	—	0·060
Right mandible, apical to first marginal (R_A)	0·05–0·06	0·057
Right mandible, first to second marginal (R_1)	0·08–0·09	0·086
Right mandible, second marginal to molar (R_m)	0·05–0·06	0·057
Mesonotum width (M)	0·21–0·24	0·216
Metanotum width (N)	0·21–0·26	0·232

Worker. Head capsule pale yellow-brown, pilosity yellow-brown, sparse but conspicuous owing to colour. Postclypeus moderately inflated, Pcl/W, 0·27–0·28, Pcl/R_1, 2·21–2·38; apical teeth of mandibles short, L_A/L_1, 0·58–0·61, R_A/R_1, 0·71–0·76; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio, $L_A/L_1.L_m$, 13·90–14·83; first marginal tooth of right mandible distinctly behind line of apical to second, its anterior margin slightly more than half length of second, $R_A/R_1.R_m$, 15·09–17·90. Fore tibia weakly inflated, T_l/T_w, 4·35–4·60, third apical spur small but more than one-quarter length of others, not vestigial. Mesenteric junction with proctodeum slightly longer than diagonal, reaching midway through malpighian knot; enteric valve seating dorsolateral in unopened abdomen, weakly three-lobed, two outer lobes almost form hood over smaller third, connected to second pouch of proctodeum by short but definite neck; membranous wall of valve beyond cushions with sparse minute spicules.

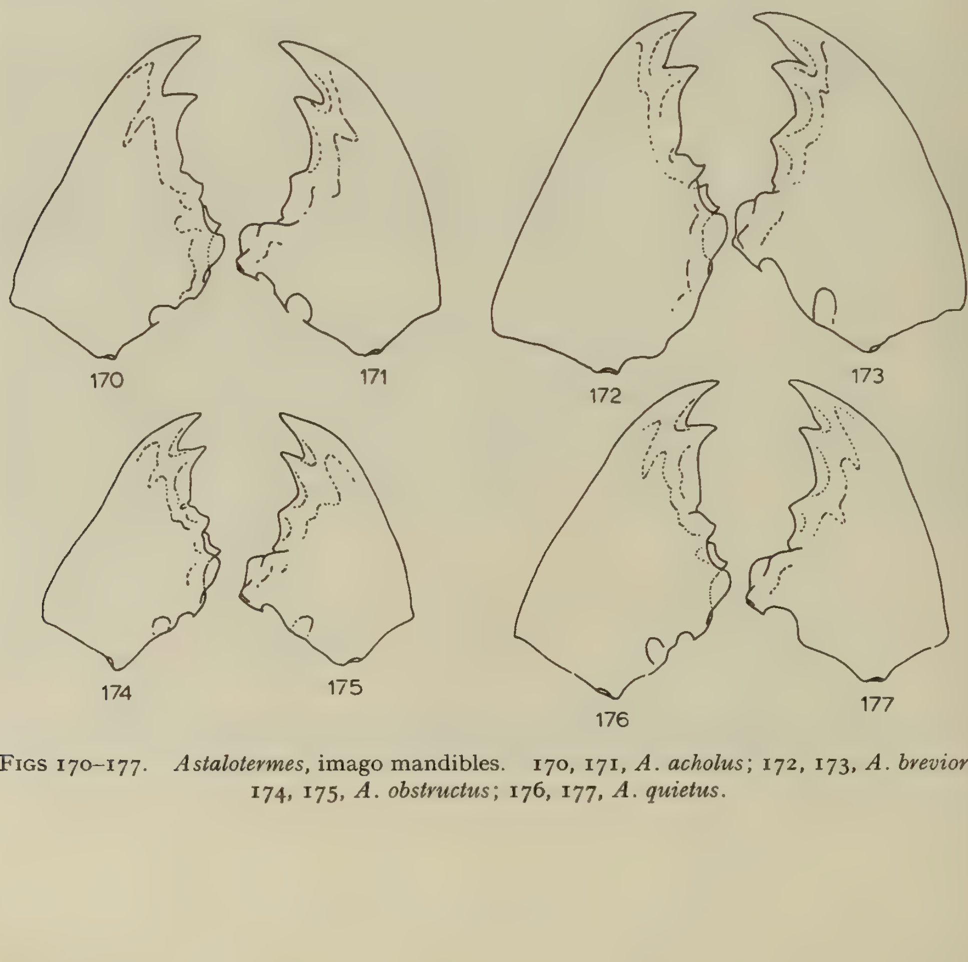
Measurements (three specimens from three localities) in millimetres.

	Range	Mean
Head width (W)	0·64–0·69	0·664
Fore tibia width (T_w)	—	0·108
Fore tibia length (T_l)	0·46–0·50	0·484
Postclypeus length (Pcl)	0·18–0·19	0·183
Left mandible, apical to first marginal (L_A)	—	0·060
Left mandible, first to third marginal (L_1)	—	0·100
Left mandible, third marginal to molar (L_m)	—	0·042
Right mandible, apical to first marginal (R_A)	0·05–0·06	0·059
Right mandible, first to second marginal (R_1)	0·08–0·09	0·080
Right mandible, second marginal to molar (R_m)	0·04–0·05	0·045

A. obstructus is smaller than any other Group III species, and has the first marginal tooth of the right mandible slightly less reduced, in both imago and worker. In this it shows affinities with Groups I and II. In the imago it is separated from all these by the closeness of the ocelli to the compound eyes. In the worker, *A. obstructus* is also distinguished from the rest of Group III by the distinctly necked enteric valve seating, from Group II species by its small size, and from Group I by the shorter right first marginal tooth. The imago of *A. obstructus* was at first confused with that of *Apagotermes stolidus* sp. n., but the meso- and metanota are proportionately wider, the postclypeus longer, and the ocelli are closer to the eyes. The worker of *A. stolidus* is easily recognized by the very characteristic armature of the enteric valve. The abdomen of the worker caste is definitely dehiscent in *A. obstructus*.

Holotype ♀ imago, paratype ♀ and ♂ imagos, and workers from type-colony, DEMOCRATIC REPUBLIC OF CONGO: Epulu R., Camp Putnam, 17.v.1948 (*A. E. Emerson*) in American Museum of Natural History. (Paratypes from type-colony, ♀ and ♂ imagos and workers, in British Museum (Natural History).)

Other paratype material. DEMOCRATIC REPUBLIC OF CONGO: Epulu R., Camp Putnam, 21.v and 22.v.1948, Yangambi, 29.v.1948 (*A. E. Emerson*) (queens, imagos, and workers) in AMNH.



FIGS 170–177. *Astalotermes*, imago mandibles. 170, 171, *A. acholus*; 172, 173, *A. brevior*; 174, 175, *A. obstructus*; 176, 177, *A. quietus*.

The four series of this species known from the depths of the Congo rain forest appear all to have been found in the nests of other genera at the base of forest trees.

Astalotermes quietus (Silvestri) **comb. n.**

(Text-figs 165–169, 176, 177 & 196–201; Pl. 1, fig. 8)

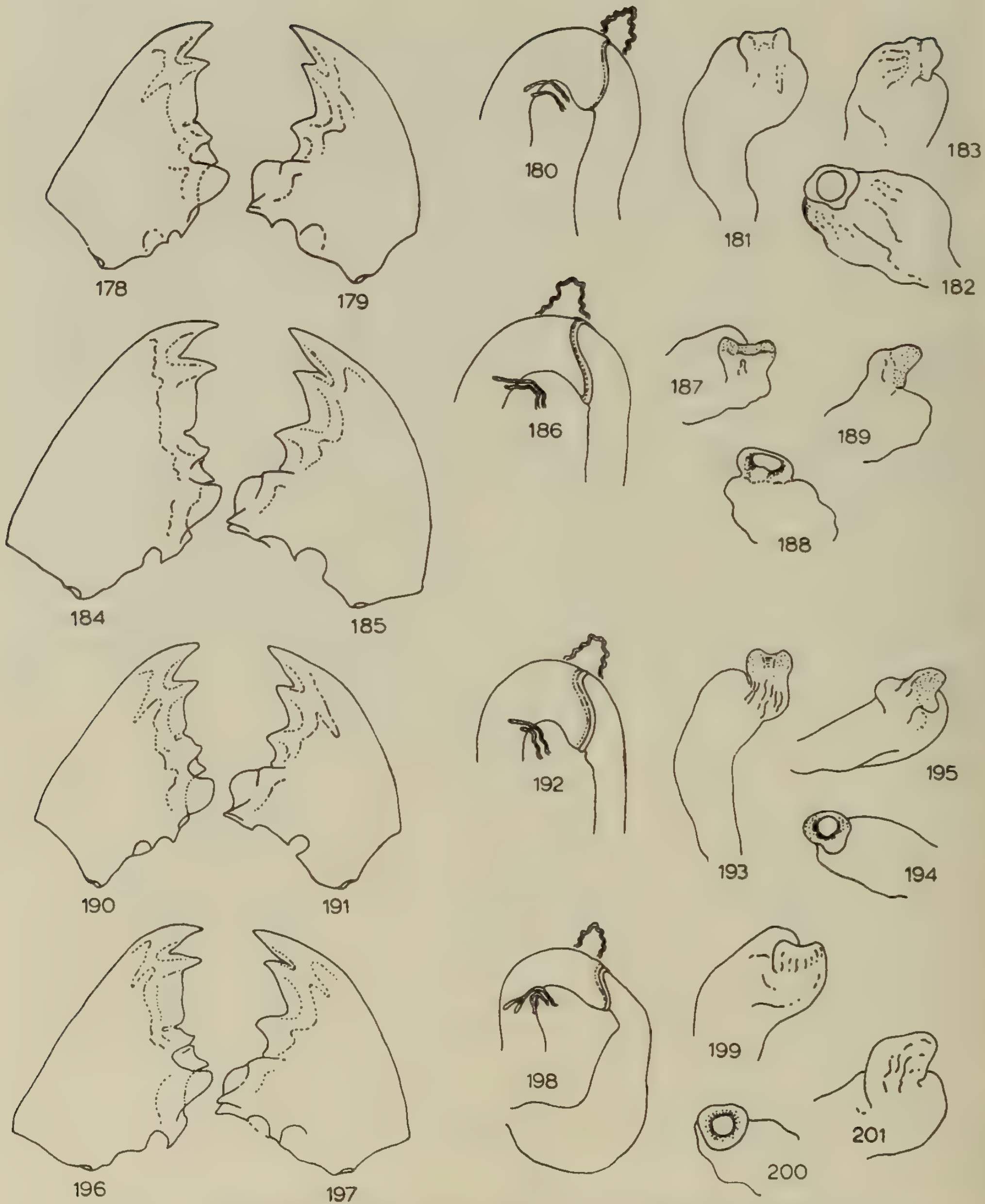
Anoplotermes quietus Silvestri, 1914 : 61. LECTOTYPE ♀, GHANA: Aburi. (Silvestri Coll., Istituto di Entomologia Agraria, Naples), here designated [examined].

Imago. Head capsule dark sepia-brown, very dark above ocelli; fontanelle variable, from broad oval near circular, to elongate oval, from distinctly smaller than ocelli to equal in size, slightly raised, flat or slightly depressed, and from yellow-white, conspicuous, to sepia-brown, scarcely paler than head; commonest form oval, smaller than ocelli, slightly depressed, paler than head; medial spot circular to elongate oval, vestigial to slightly smaller than fontanelle, flat or slightly raised, coloured as head; postclypeus brown to dark sepia-brown, labrum pale brown; antennae brown. Pronotum sepia-brown, meso- and metanota brown, usually with transverse dark sutures; femora brown, tibiae yellow-brown, tarsi yellow. Abdominal tergites and dorsal stigmata sepia-brown, sternites brown, yellow in middle, ventral stigmata brown; cerci yellow-white to pale brown.

Posterior margin of head capsule undulating, rarely approaching evenly rounded; ocelli medium-sized, distance from compound eyes varies from one-quarter, to slightly less than own least diameter; postclypeus very weakly to moderately inflated, Pcl/W, 0·18–0·27, Pcl/R_A, 2·06–3·48, posterior margin evenly rounded in most, sometimes bowed, median suture commonly weak or absent, especially in less inflated forms. Apical teeth of mandibles short, L_A/L_1, 0·42–0·55, R_A/R_1, 0·55–0·74; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$; first marginal tooth of right mandible slightly behind line of apical to second marginal, its anterior margin distinctly shorter than that of second. Pilosity of head capsule brown, short setae an even pelt with longer scattered emergent setae. Meso- and metanota less narrow, somewhat wider at constriction, M/W, 0·26–0·34. Fore tibia with third apical spur shorter but distinct.

Measurements (34 specimens from 23 localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	0·82–1·06	0·917 ± 0·061
Ocellus ($O_w \times O_l$) . .	0·06–0·10 × 0·08–0·14	0·079 ± 0·008 × 0·108 ± 0·013
Ocellus to eye (O–E) . .	0·02–0·08	0·047 ± 0·013
Postclypeus length (Pcl) .	0·16–0·28	0·221 ± 0·027
Antennal article III . .	0·02–0·05	0·033 ± 0·008
Antennal article IV . .	0·03–0·06	0·044 ± 0·007
Antennal article V . .	0·02–0·06	0·043 ± 0·007
Left mandible, apical to first marginal (L_A) . .	0·06–0·09	0·069 ± 0·008
Left mandible, first to third marginal (L_1) . .	0·13–0·17	0·147 ± 0·011
Left mandible, third marginal to molar (L_m) .	0·06–0·08	0·067 ± 0·006
Right mandible, apical to first marginal (R_A) . .	0·06–0·09	0·073 ± 0·008
Right mandible, first to second marginal (R_1) .	0·10–0·13	0·115 ± 0·008
Right mandible, second marginal to molar (R_m) .	0·06–0·08	0·067 ± 0·008
Mesonotum width (M) .	0·21–0·34	0·269 ± 0·031
Metanotum width (N) .	0·23–0·34	0·275 ± 0·029



FIGS 178–201. *Astalotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seatings. 178–183, *A. acholus*; 184–189, *A. brevior*; 190–195, *A. obstructus*; 196–201, *A. quietus*.

Worker. Head capsule yellow-white, pilosity pale yellow, sparse, inconspicuous. Postclypeus weakly to strongly inflated, Pcl/W, 0·24–0·35, Pcl/R_l, 1·89–2·97; apical teeth of mandibles short, L_A/L_l, 0·43–0·54, R_A/R_l, 0·57–0·76; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 7·25–11·41; first marginal of right mandible distinctly behind line of apical to second, its anterior margin half length of second or less, $R_A/R_l.R_m$, 9·94–13·08. Fore tibia scarcely inflated, T_l/T_w, 4·21–5·52, third apical spur distinct, about one-third length of other two. Mesenteric junction with proctodeum diagonal, to right of malpighian knot; enteric valve seating dorso-lateral in unopened abdomen, weakly two-lobed, sessile or second pouch of proctodeum or with very short neck; membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (20 specimens from 20 localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	0·71–0·90	0·791 ± 0·055
Fore tibia width (T_w)	0·10–0·14	0·122 ± 0·009
Fore tibia length (T_l)	0·50–0·66	0·583 ± 0·048
Postclypeus length (Pcl)	0·18–0·29	0·229 ± 0·029
Left mandible, apical to first marginal (L_A)	0·05–0·08	0·064 ± 0·007
Left mandible, first to third marginal (L_l)	0·11–0·15	0·129 ± 0·008
Left mandible, third marginal to molar (L_m)	0·04–0·06	0·052 ± 0·006
Right mandible, apical to first marginal (R_A)	0·05–0·08	0·064 ± 0·007
Right mandible, first to second marginal (R_l)	0·09–0·11	0·099 ± 0·008
Right mandible, second marginal to molar (R_m)	0·04–0·06	0·056 ± 0·006

A. quietus is another variable species, which closely resembles *A. brevior* in some of its forms. The differences have already been discussed under that species. The variation in the degree of development of the postclypeus and its median suture is of particular interest. This is most marked in the worker but is reflected in the corresponding imagos. The species has been found in a range of habitats from deep rain forest to small thicket clumps in the savanna zones or even in mounds of other species in open savanna. In the forest specimens the postclypeus tends to be least developed, often lacking a median suture in the imago. The savanna forms have a well developed postclypeus and median suture. The postclypeus is the point at which the cibarial dilator muscles which lift the roof of the buccal cavity are attached. It is therefore probable that the increasing size of the postclypeus in drier conditions accommodates larger muscles better adapted to work the drier soil on which the termites feed. This admittedly speculative interpretation of directional variation appears reasonable in view of the poor flying and hence dispersive powers of these small termites which would tend to perpetuate locally adaptive variants. The same characters of *A. obstructus* that separated it from *A. brevior* also serve to distinguish it from *A. quietus*. Of the other species of *Astalotermes*, *A. benignus* and *A. concilians* are sympatric with *A. quietus*. The small size of *A. benignus* and the vestigial third apical spur of the fore tibia are distinctive; in *A. concilians* the postclypeus is usually more inflated, the meso- and metanota narrower in the imago, and the first marginal tooth of the right mandible is larger. The phenomenon of worker abdominal dehiscence apparently reaches its peak with *A. quietus* in which it is difficult to find an unburst specimen for dissection in most nest-series.

A lectotype has been designated below from the syntype-series of *A. quietus*.

Type-material. *Anoplotermes quietus* Silvestri, LECTOTYPE ♀ imago, paralectotype nymphs and workers from type-colony, GHANA: Aburi, 20.i.1913 (*F. Silvestri*), in Silvestri Coll., Istituto di Entomologia Agraria, Portici, Naples; other paralectorype ♀ imago in AMNH.

Other material. SIERRA LEONE: Kenema, 14.i.1958 (*W. Wilkinson*). GUINEA: Mount Nimba (nine vials), viii, ix.1946 and viii–x.1951 (*M. Lamotte*). IVORY COAST: Banco Forest, 5°22'N., 4°03'W. (three vials), 6.i, 10.i and 10.ii.1962, Bouaflé Forest, 26.ii.1962, Lamto, 5°52'N., 4°46'W., 8.vi.1964 (*E. Ernst*); Banco Forest, 29.vii.1963 (*C. Noirot*); Youhouli, 10 km N. of Dabou (two vials), 16–18.iv.1963 (*P. Bodot*); N'Douci, Lamto, 25.iii, Banco Forest, 21.viii.1950 (*G. Josens*). GHANA: 6 m. N. of Wa on Lawra Road, 19.iii, 52 m. S. of Wa on Sawla Road, 20.iii, 3 m. from Larabanga on Sawla Road, 22.iii, 12 m. from Damongo on Tamale Road, 24.iii, and 7 m. S. of Akumadam on Wenchi–Kumasi Road, 1.iv.1959 (*W. A. Sands*). NIGERIA: Eastern Region; Aba, 27.xii.1956, 47 m. from Enugu on Onitsha Road, 21.i, Onitsha, 5.iv, Port Harcourt 2.v, and 40 m. from Port Harcourt on Owerri Road, 19.vi.1957 (*W. Wilkinson*); Western Region; Olokemeji, near Ibadan, xi.1912 (*F. Silvestri*) (listed in original description, hence paralectotypes not from type-colony), Inst. Ent. Agr., Portici; Northern Region, 18 m. from Kaduna on Zaria Road, 8.xii.1956, Riom, 14.ii, Kwei, 4 m. W. of Jos (two vials), 29.iii, 32 m. from Jos on Kaduna Road, 5.iv, 55 m. from Damaturu on Potiskum Road, 5.vi.1957 and Samaru, near Zaria, 18.v.1959 (*W. A. Sands*). DEMOCRATIC REPUBLIC OF CONGO: St. Gabriel, near Stanleyville, (three vials), 1916 (*H. Kohl*); Stanleyville, 26.v and 3 km from Leopoldville (Kinshasa) on Thysville Road, 16.vi.1948 (*A. E. Emerson*); Yangambi, 30.v.1948 (*W. Emerson*) AMNH; Garamba, 15.iii.1951 (*H. de Saeger*); Kivu District, Wangi (two vials), 2–3.xi.1963 (*E. Ernst*); Mayumbe District, Luki, 19.iv.1965 (*A. Bouillon*); Mondongo District, Lisala, 30.ix.1966 (*J. Ruelle*). RWANDA: Bugesera, 15.xi.1963 (*A. Bouillon*). CONGO (BRAZZAVILLE:) 13 km W. of Brazzaville, 8.vi.1948 (*A. E. Emerson*), AMNH.

A total of 51 nest-series of this species have been examined, and material is in the BMNH except where stated otherwise. More is known of its biology than of any other African member of the group. *A. quietus* has been described by a number of authors as making small 'nests' of a few chambers on twigs or creepers a little above ground level in rain forest. One such was illustrated by Emerson (1928). The 'nest' is sometimes plastered on the side of a tree-trunk. In open savanna this species is commonly found in the mounds of *Cubitermes* spp. The very wide distribution of *A. quietus* from the Western Guinean Savanna to the southern Congo forest is only exceeded by one species of another genus, *Alyscotermes kilimandjaricus* (Sjöstedt).

Other Species

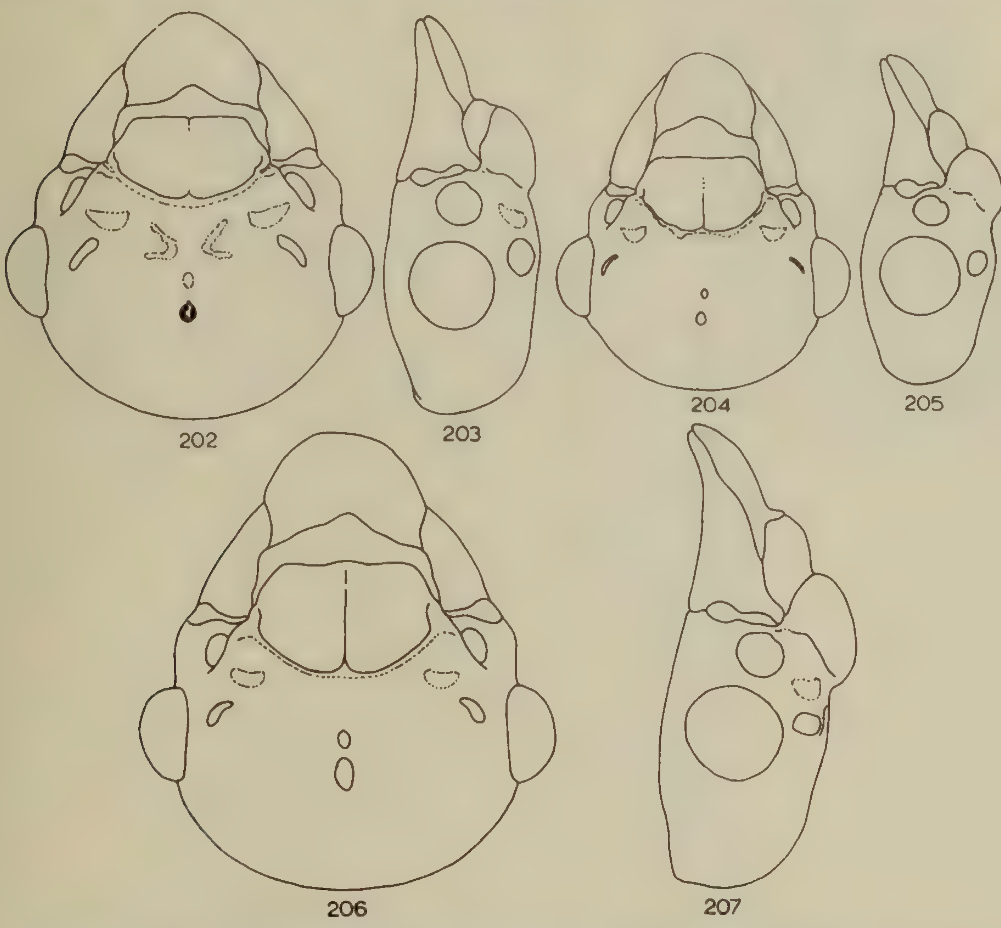
Astalotermes empodius sp. n.

(Text-figs 202, 203, 208, 209 & 214–219; Pl. 1, fig. 9)

Imago. Head capsule dark sepia-brown, very dark above ocelli; fontanelle short oval, half size of ocelli or less, depressed, yellow-white to brown; medial spot short oval, very slightly

raised, same size as fontanelle, dark sepia-brown; postclypeus brown to sepia-brown, labrum yellow-brown, frontal marks distinct, semicircular, depressed, brown; antennae brown. Pronotum, meso- and metanota, sepia-brown, transverse dark suture distinct in metanotum only, weak or absent in mesonotum; legs, femora brown, tibiae yellow-brown, tarsi yellow. Abdominal tergites sepia-brown; dorsal stigmata pale brown, sternites brown laterally; paler in middle, ventral stigmata pale brown, cerci pale yellow.

Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by two-thirds own least diameter or more; postclypeus weakly inflated, Pcl/W, 0·22–0·24, Pcl/R_A, 2·73–3·15, posterior margin bowed or regularly rounded, median suture usually absent, sometimes weakly present. Apical teeth of mandibles short, L_A/L_1, 0·46–0·48, R_A/R_1, 0·62–0·70; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 4·54–5·50; apical and marginal teeth of right mandible in line, anterior edge of first marginal slightly longer than that of second. Pilosity of head capsule dense, brown, uneven, not forming a pelt. Meso- and metanota less narrow at constriction, M/W, 0·26–0·28. Fore tibia with third apical spur distinct, nearly as large as other two.



FIGS 202–207. *Astalotermes*, imago head capsules, front and side views. 202, 203, *A. empodius*; 204, 205, *A. impedians*; 206, 207, *A. irrixosus*.

Measurements (eight specimens from five localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	1·13–1·25	1·190 ± 0·044
Ocellus ($O_w \times O_l$) . .	0·08–1·10 × 0·12–0·15	0·095 ± 0·006 × 0·133 ± 0·011
Ocellus to eye (O–E) .	0·07–0·10	0·086 ± 0·009
Postclypeus length (Pcl) .	0·25–0·30	0·277 ± 0·016
Antennal article III . .	0·02–0·04	0·031 ± 0·006
Antennal article IV . .	0·04–0·06	0·047 ± 0·005
Antennal article V . .	0·05–0·06	0·049 ± 0·003
Left mandible, apical to first marginal (L_A) .	0·08–0·09	0·088 ± 0·002
Left mandible, first to third marginal (L_1) . .	0·18–0·20	0·189 ± 0·006
Left mandible, third marginal to molar (L_m) .	0·09–0·10	0·093 ± 0·007
Right mandible, apical to first marginal (R_A) .	0·09–0·10	0·093 ± 0·003
Right mandible, first to second marginal (R_1) .	0·14–0·15	0·141 ± 0·005
Right mandible, second marginal to molar (R_m) .	0·09–0·10	0·095 ± 0·006
Mesonotum width (M) .	0·25–0·34	0·300 ± 0·031
Metanotum width (N) .	0·28–0·35	0·317 ± 0·029

Worker. Head capsule yellow-white, pilosity pale yellow, sparse and inconspicuous. Postclypeus moderately inflated, Pcl/W, 0·29–0·30, Pcl/R_1, 2·31–2·56; apical teeth of mandibles short, L_A/L_1, 0·50–0·53, R_A/R_1, 0·75–0·76; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 9·87–10·00; apical and marginal teeth of right mandible in line, $R_A/R_1.R_m$, 11·89–12·78. Fore tibia scarcely inflated, T_l/T_w, 4·33–4·73, third apical spur small but more than one-quarter other two, not vestigial. Mesenteric junction with proctodeum slightly longer than diagonal, but well to right of malpighian knot; enteric valve seating dorsolateral, almost dorsal, in unopened abdomen, prominently three-lobed, third, inner lobe smaller than outer two, almost completely sessile on second pouch of proctodeum; membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (two specimens from two localities) in millimetres.

Head width (W)	0·88–0·89
Fore tibia width (T_w) . . .	0·14–0·15
Fore tibia length (T_l) . . .	0·65–0·66
Postclypeus length (Pcl) . . .	0·26
Left mandible, apical to first marginal (L_A)	0·08–0·09
Left mandible, first to third marginal (L_1)	0·15–0·16
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A)	0·08–0·09
Right mandible, first to second marginal (R_1)	0·10–0·11
Right mandible, second marginal to molar (R_m)	0·06

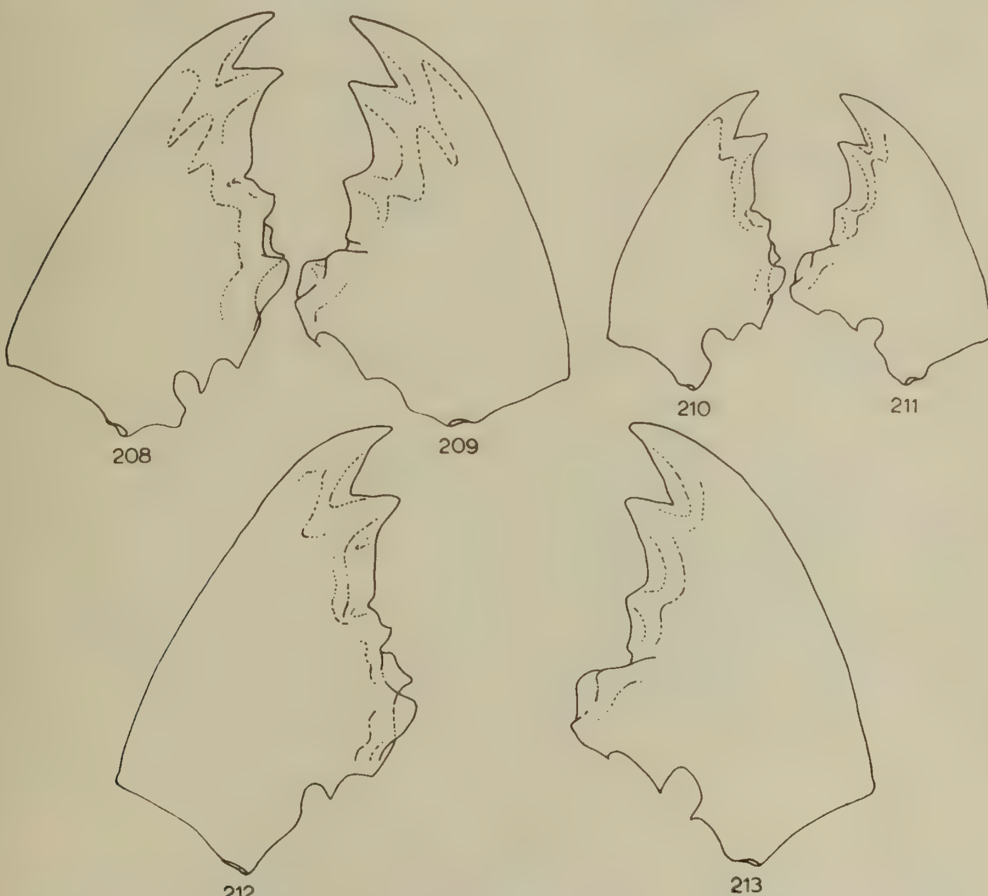
A. empodius will not be confused with any Group I species because it is much larger. Comparisons with Group II species have been made under the headings of its members. In Group III the only species likely to be confused with it is *A. brevior*.

This is distinguishable in the imago by the always distinct median suture of the postclypeus, in both castes by the differing proportions of the mandibular teeth, and further in the worker by the weakly lobed enteric valve seating. It is not known if the abdomen is dehiscent in the worker of *A. empodius*.

Holotype ♀ imago, paratype ♀ and ♂ imagos, and workers, from type-colony, Republic of South Africa: Natal, Haviland Rail, xi.1918 (*C. Fuller*, coll. No. F939) in National Collection of Isoptera, Pretoria. (Paratype ♀ and ♂ imagos, and workers from type colony, also in AMNH and BMNH.)

Other paratype material. Republic of South Africa: Natal, Estcourt (*G. D. Haviland*, Nos in Fuller collection, F.367, F.936); upper valley or Mkusi River, near Magut, 4.iii.1921 (*G. C. Haines*, No. in Fuller collection F1234); Klipriver, 26.x.1956 (*W. G. H. Coaton*), in N.C.I., Pretoria and AMNH.

The only biological information available for this species is that it has been collected from the mounds of *Cubitermes bilobatus* (Haviland).

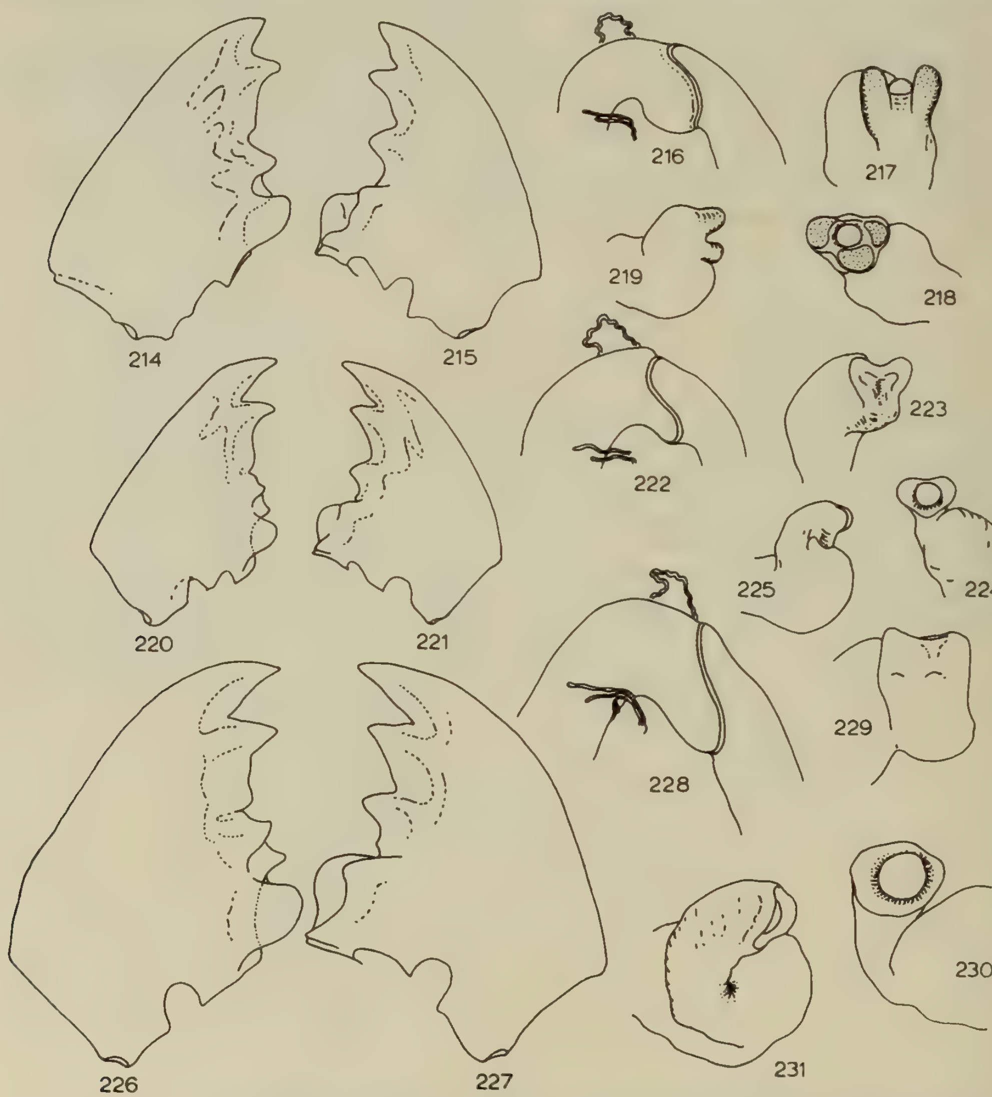


Figs 208–213. *Astalotermes*, imago mandibles. 208, 209, *A. empodius*; 210, 211, *A. impedians*; 212, 213, *A. irrixosus*.

***Astalotermes impedians* sp. n.**

(Text-figs 204, 205, 210, 211 & 220–225)

Imago. Head capsule brown, not darker above ocelli; fontanelle short oval, less than half size of ocelli, slightly depressed, pale brown; medial spot oval, flat, smaller than fontanelle, brown; postclypeus pale brown, labrum pale yellow; frontal marks small rather indistinct flat pale brown crescents; antennae pale yellow-brown. Pronotum, yellow-brown, meso- and metanota pale yellow-brown, transverse sutures absent on meso-, very weak on metanotum;



FIGS 214–231. *Astalotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seatings. 214–219, *A. empodius* (mandibles heavily worn); 220–225, *A. impedians*; 226–231, *A. irrixosus*.

legs, femora yellow-brown, tibiae pale yellow, tarsi yellow-white. Abdominal tergites and dorsal stigmata pale yellow-brown, sternites and ventral stigmata still paler; cerci yellow.

Posterior margin of head capsule evenly rounded; ocelli small, separated from compound eyes by about two-thirds own least diameter; postclypeus moderately inflated, Pcl/W, 0·26, Pcl/R_A, 3·42–3·68, posterior margin somewhat undulating, median suture weak. Apical teeth of mandibles short, L_A/L_1, 0·41–0·53, R_A/R_1, 0·62–0·65; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio $L_A/L_1.L_m$, 7·50–8·75; apical and marginal teeth of right mandible in line, anterior edge of first marginal longer than that of second. Pilosity of head capsule pale yellow-brown, uneven, no pelt. Meso- and metanota less narrow at constriction M/W, 0·26–0·27. Fore tibia with third apical spur only slightly smaller than other two.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W) .	0·86–0·94
Ocellus ($O_w \times O_l$) . . .	0·06–0·07 × 0·08–0·09
Ocellus to eye (O–E) . .	0·04
Postclypeus length (Pcl) . .	0·23–0·24
Antennal article III . . .	0·04
Antennal article IV . . .	0·04
Antennal article V . . .	0·05
Left mandible, apical to first marginal (L_A) . . .	0·07
Left mandible, first to third marginal (L_1) . . .	0·12–0·14
Left mandible, third marginal to molar (L_m)	0·060–0·07
Right mandible, apical to first marginal (R_A) . . .	0·07
Right mandible, first to second marginal (R_1) . . .	0·10–0·11
Right mandible, second marginal to molar (R_m) . . .	0·05–0·06
Mesonotum width (M) . .	0·23–0·25
Metanotum width (N) . .	0·24–0·28

Worker. Head capsule pale yellow, pilosity similarly coloured, fine, silky, inconspicuous but fairly dense. Postclypeus weakly inflated, Pcl/W, 0·25, Pcl/R_1, 1·91; apical teeth of mandibles short, L_A/L_1, 0·54, R_A/R_1, 0·74, subsidiary marginal tooth of left mandible separated from molar prominence by wide notch in surface view, complex ratio $L_A/L_1.L_m$, 12·45; first marginal of right mandible slightly behind line of apical to second marginal, anterior edges of marginal teeth approximately equal, $R_A/R_1.R_m$, 15·91. Fore tibia weakly inflated, T_l/T_w, 4·47, third apical spur small but not vestigial, about one-third other two. Mesenteric junction with proctodeum diagonal, to right of malpighian knot; enteric valve seating lateral in unopened abdomen, two outer lobes well developed, third lobe vestigial, connected to second pouch of proctodeum by fairly long neck; membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (one specimen) in millimetres.

Head width (W)	0·71
Fore tibia width (T_w)	0·12
Fore tibia length (T_l)	0·52
Postclypeus length (Pcl) . . .	0·18
Left mandible, apical to first marginal (L_A)	0·07
Left mandible, first to third marginal (L_1) .	0·12

Left mandible, third marginal to molar (L_m)	0·04
Right mandible, apical to first marginal (R_A)	0·07
Right mandible, first to second marginal (R_1)	0·10
Right mandible, second marginal to molar (R_m)	0·05

This medium-sized species, as stated in the introduction to the genus, resembles the Group I species. It differs from *A. amicus* in the proportionately longer postclypeus and shorter apical teeth of the mandibles. The very different proportions of the mandibles, and in the worker, the gut characters, distinguish *A. comis*. *A. eumenus* has narrower meso- and metanota and longer apical teeth. The other species of Group I are not likely to be sympatric with *A. impedians* and are in any case separable by similar characters. In Group II, *A. hapalus* is rather similar in the imago though larger with wider meso- and metanota, and more inflated postclypeus. In the worker the apical teeth of the mandibles are longer and the postclypeus much more inflated. *A. mitis* is likewise distinguished from *A. impedians* except that the imago postclypeus is not more inflated. *A. murcus* from the same locality as *A. impedians* is much larger with characteristic long head setae. In Group III, *A. brevior* shows resemblances in some forms of the imago, though usually much darker with pronounced transverse sutures on meso- and metanota, and the proportions of mandibular teeth are different. The mandible characters are accentuated in the worker, which also has an almost sessile enteric valve seating. It is not known whether the worker abdomen is dehiscent in *A. impedians*.

Holotype ♀ imago, paratype ♂ imago and worker from type-colony, ZAMBIA: Ndola 30.i.1957 (*W. G. H. Coaton*) in National Collection of Isoptera, No. TM4111, Pretoria.

No other material of this species is known and there is no information on its biology.

Astalotermes irrixosus sp. n.

(Text-figs 206, 207, 212, 213 & 226–231; Pl. 1, fig. 10)

Imago. Head capsule dark chestnut-brown, very dark above ocelli; fontanelle oval, somewhat smaller than ocelli, slightly depressed, chestnut-brown; medial spot oval, flat, equal in size to fontanelle or slightly smaller, colour as head; postclypeus brown, labrum yellow-brown; frontal marks distinct chestnut-brown depressed crescents; antennae brown. Pronotum, meso- and metanota, chestnut-brown, transverse dark sutures present; legs, femora yellow-brown, tibiae paler, tarsi yellow. Abdominal tergites and dorsal stigmata, ventral stigmata and lateral parts of sternites, brown; middle of sternites, and cerci, pale yellow-brown.

Posterior margin of head capsule evenly rounded; ocelli rather small, separated from compound eyes by two-thirds to five-sixths own least diameter; postclypeus moderately inflated, Pcl/W, 0·26–0·27, Pcl/R_A, 2·92–3·17, posterior margin evenly rounded, median suture distinct. Apical teeth of mandibles short, L_A/L_1, 0·52, R_A/R_1, 0·76–0·78; subsidiary marginal tooth of left mandible separated from molar prominence by wide notch in surface view, complex ratio $L_A/L_1.L_m$, 5·21–5·22; apical and marginal teeth of right mandible in line, anterior edge of first

marginal nearly twice length of second. Pilosity of head capsule chestnut-brown, uneven, no pelt. Meso- and metanota distinctly wider at constriction, M/W, 0·33–0·36. Fore tibia with third apical spur only slightly smaller than other two.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W)	1·24–1·33
Ocellus ($O_w \times O_l$)	0·09 × 0·12–0·13
Ocellus to eye (O–E)	0·06–0·08
Postclypeus length (Pcl)	0·33–0·36
Antennal article III	0·05
Antennal article IV	0·07–0·08
Antennal article V	0·07
Left mandible, apical to first marginal (L_A)	0·10–0·11
Left mandible, first to third marginal (L_l)	0·19–0·20
Left mandible, third marginal to molar (L_m)	0·10
Right mandible, apical to first marginal (R_A)	0·11
Right mandible, first to second marginal (R_l)	0·14–0·15
Right mandible, second marginal to molar (R_m)	0·10
Mesonotum width (M)	0·41–0·48
Metanotum width (N)	0·43–0·48

Worker. Head capsule orange-yellow, pilosity yellow-brown, sparse but long, coarse and conspicuous. Postclypeus weakly inflated, Pcl/W, 0·25, Pcl/R_l, 2·39; apical teeth of mandibles moderately long, L_A/L_l, 0·73, R_A/R_l, 1·00; subsidiary marginal tooth of left mandible separated from molar prominence by wide notch in surface view, complex ratio, $L_A/L_l.L_m$, 9·30; first marginal of right mandible very slightly behind line of apical to second marginal, anterior edge of first marginal slightly longer than that of second, $R_A/R_l.R_m$, 13·09. Fore tibia slender, T_l/T_w, 5·96, third apical spur vestigial, one-fifth or less length of other two. Mesenteric junction with proctodeum slightly longer than diagonal, to right of malpighian knot; enteric valve seating dorsolateral in unopened abdomen, very weakly bilobed, connected to second pouch of proctodeum by long neck; membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (one specimen) in millimetres.

Head width (W)	1.08
Fore tibia width (T_w)	0·14
Fore tibia length (T_l)	0·81
Postclypeus length (Pcl)	0·27
Left mandible, apical to first marginal (L_A)	0·12
Left mandible, first to third marginal (L_l)	0·16
Left mandible, third marginal to molar (L_m)	0·08
Right mandible, apical to first marginal (R_A)	0·11
Right mandible, first to second marginal (R_l)	0·11
Right mandible, second marginal to molar (R_m)	0·08

A. irrixosus is the largest species in the genus, although it is approached in size by *A. murcus*, the largest *A. brevior* and *A. empodius*. The characters separating it from *A. murcus* have already been noted; other comparisons are made in the discussions of *A. ignavus* and *A. mitis*. In *A. brevior* the proportions of the mandibles are different in both castes, and the enteric valve seating is sessile. The proportions of the mandibular teeth also distinguish *A. empodius* which in addition has a prominently lobed sessile enteric valve seating. *A. irrixosus* was at first grouped with *Alyscotermes* but this genus has a prominently spined enteric valve, and has the third apical spur well developed on the worker fore tibia, not vestigial. The abdomen of the worker of *A. irrixosus* appears to be dehiscent, but not very markedly so, since the specimens have not burst completely.

Holotype ♀ imago, paratype ♂ imago, workers and nymphs from type-colony, SUDAN: Equatoria Province, Imatong Mountains, 24.vii–5.viii.1939 (*N. A. Weber*), in American Museum of Natural History; paratype ♀ imago and worker in BMNH.

Only the type-series is known, and, apart from the comment on the label 'In separate cells in *Polyrhachis* earth mound, 4500'', there is no information on its biology.

ADYNATOTERMES gen. n.

(Adynatos, Gr., 'weak, without strength')

Type-species: *Mirotermes* (*? Procubitermes*) *moretelae* Fuller, 1925 : 191

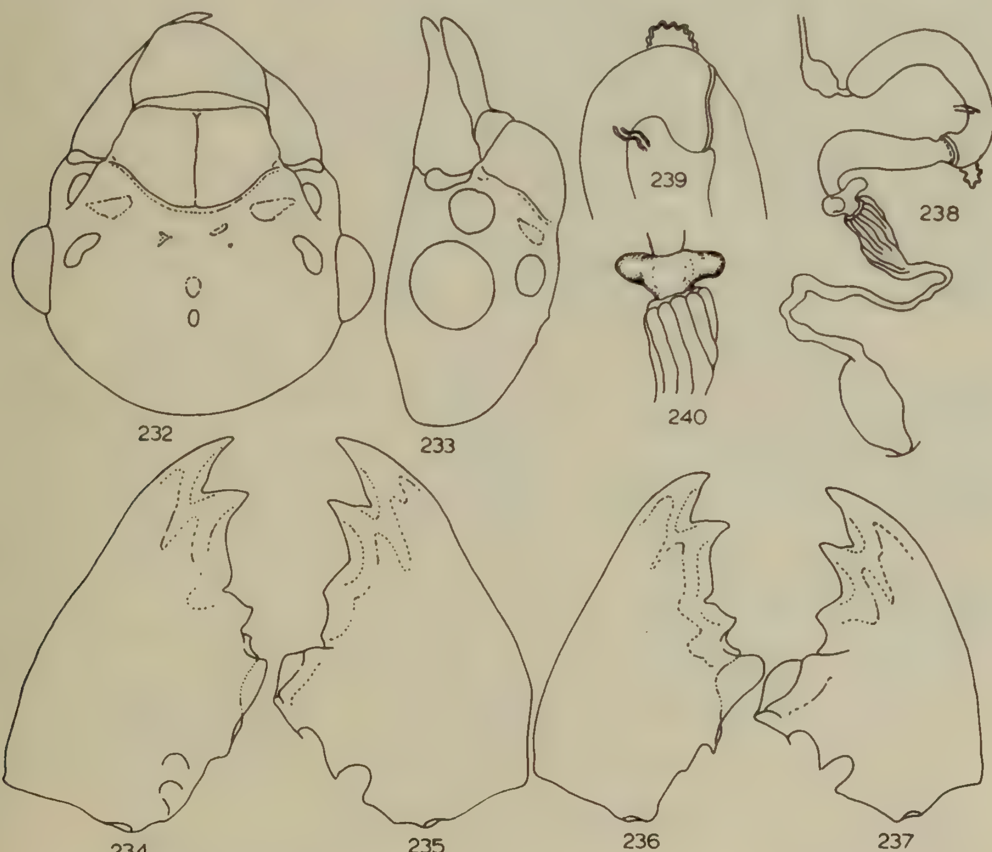
Imago. Large-sized, W, 1·14–1·21. Fore tibia with three apical spurs, third well developed, almost equal to other two. Apical teeth of mandibles short, L_A/L_l, 0·51–0·57, R_A/R_l, 0·73–0·87; subsidiary marginal tooth of left mandible with proximal end just level with edge of molar prominence in surface view, complex ratio $L_A/L_l.L_m$, 5·98–6·68. Points of apical and marginal teeth of right mandible in line, anterior edges of marginal teeth equal. Meso- and metanota rather narrow at constriction, M/W, 0·24–0·28, transverse dark sutures absent.

Worker. Large, W, 0·85–0·90. Fore tibia weakly swollen. T_l/T_w, 4·13–4·54, with three apical spurs, third about half length of other two. Apical teeth of mandibles short, L_A/L_l, 0·53–0·60, R_A/R_l, 0·75–0·82; subsidiary marginal tooth of left mandible with proximal end level with edge of molar prominence in surface view, complex ratio $L_A/L_l.L_m$, 10·50–11·86. Points of apical and marginal teeth of right mandible in line, anterior edge of marginal teeth equal, complex ratio $R_A/R_l.R_m$, 11·90–16·50. Mesenteric junction with proctodeum only slightly angled, almost transverse, to right of malpighian knot. Enteric valve seating with two opposite erect lobes, almost diverticula, connected to second pouch of proctodeum by very short neck, lateroventral in position in unopened abdomen; internal cushions of enteric valve without armature, surface faintly reticulated only.

This genus contains a single species, and is separated from *Astalotermes* chiefly on account of the unique development of the enteric valve seating. In the multivariate similarity analysis, *A. moretelae* is placed close to *Astalotermes empodius*, *A. aganus* and *A. mitis*, both by clustering methods and when plotted as principal co-ordinates. In the latter it is separable from them only by the value of its elements in the fourth and fifth latent vectors. The canonical variates based on the measurements of both imago and worker castes show the same close similarity to *Astalotermes*. Thus it was with some hesitation that *A. moretelae* was consigned

to a further monotypic genus. However, as in *Acidnotermes*, the subsidiary marginal tooth of the left mandible has scarcely emerged from behind the molar prominence. The gut of the worker is shorter than in most *Astalotermes*. In the imago, the fontanelle is usually raised on a distinct bump, and the medial spot is always raised on a second, more prominent bump. These features are found in several other genera, and suggest that although the enteric valve seating is clearly specialized, a number of probably ancestral characteristics have been retained.

Apart from the mandible and fontanelle characters already mentioned, *A. moretelae* differs from *Astalotermes aganus* in the imago in having the ocelli much closer to the eyes; in the worker the two-lobed short-necked enteric valve seating contrasts with the three-lobed long-necked structure of the latter species. The valve seating is also three-lobed in *A. empodius*, which has a shorter postclypeus. This is also true of *A. mitis*, and the worker caste of this species has a long-necked



FIGS 232–240. *Adynatotermes moretelae*. 232, 233, front and side views of imago head capsule; 234, 235, imago mandibles; 236, 237, worker ditto; 238, entire worker intestine; 239, mesenteric-proctodeal junction showing attachment of malpighian tubules and position of malpighian knot; 240, enteric valve seating.

valve seating. *Aganotermes oryctes* sp. n. is sympatric with *A. moretelae* and resembles it slightly in the imago, but the apical teeth of the mandibles are much longer.

Adynatotermes moretelae (Fuller) comb. n.

(Text-figs 232–240; Pl. 1, fig. 11)

Mirotermes (? *Procubitermes*) *moretelae* Fuller, 1925 : 191. LECTOTYPE ♂, Republic of South Africa: Pienaars River. (National Collection of Isoptera, Pretoria) here designated [examined].

Imago. Head capsule brown to sepia-brown, darker above ocelli, dark areas often extending as tapering streaks converging to fontanelle; fontanelle small, short oval, about one-third length of ocellus or less, usually raised on slight bump but sometimes flat or slightly depressed, pale brown, often enclosed by dark area; medial spot short oval, equal to fontanelle or slightly larger, raised on more distinct bump, pale brown; postclypeus yellow to yellow-brown, labrum yellow; frontal marks distinct, flat pale brown crescents; antennae pale yellow-brown. Pronotum, meso- and metanota pale brown to brown; femora pale yellow-brown, tibiae and tarsi yellow. Abdominal tergites, pale brown to brown, sternites pale brown, paler in middle, dorsal and ventra stigmata paler than sclerites; cerci yellow-white.

Posterior margin of head capsule not quite evenly rounded, slightly undulating; ocelli rather large, separated from compound eyes less than half, up to near, own least diameter; postclypeus moderately inflated, Pcl/W, 0·27–0·31, posterior margin bowed, not evenly rounded, median suture distinct. Pilosity of head capsule dense, short, coarse, and uneven in length, not forming a pelt. Other characters in generic diagnosis.

Measurements (13 specimens from eight localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	1·14–1·21	1·165 ± 0·023
Ocellus ($O_w \times O_l$)	0·10–0·13 × 0·13–0·16	0·111 ± 0·007 × 0·142 ± 0·009
Ocellus to eye (O–E)	0·04–0·09	0·073 ± 0·016
Postclypeus length (Pcl)	0·33–0·36	0·343 ± 0·011
Antennal article III	0·03–0·05	0·038 ± 0·007
Antennal article IV	0·04–0·07	0·056 ± 0·008
Antennal article V	0·05–0·06	0·060 ± 0·004
Left mandible, apical to first marginal (L_A)	0·09–0·10	0·099 ± 0·003
Left mandible, first to third marginal (L_1)	0·18–0·19	0·184 ± 0·003
Left mandible, third marginal to molar (L_m)	0·08–0·09	0·086 ± 0·003
Right mandible, apical to first marginal (R_A)	0·10–0·11	0·106 ± 0·003
Right mandible, first to second marginal (R_1)	0·13–0·14	0·135 ± 0·004
Right mandible, second to marginal to molar (R_m)	0·08–0·09	0·085 ± 0·004
Mesonotum width (M)	0·28–0·33	0·299 ± 0·016
Metanotum width (N)	0·28–0·33	0·302 ± 0·014

Worker. Head capsule and pilosity pale yellow, setae fairly numerous but short and inconspicuous. Postclypeus strongly inflated, Pcl/W, 0·31–0·34, Pcl/R_1, 2·53–2·77. Mem-

branous wall of enteric valve beyond cushions with sparse minute spicules. Other characters given in generic diagnosis.

Measurements (seven specimens from seven localities) in millimetres.

	Range	Mean ± S.D.
Head width (W)	0·85–0·90	0·879 ± 0·019
Fore tibia width (T_w)	0·14–0·16	0·144 ± 0·008
Fore tibia length (T_l)	0·60–0·65	0·623 ± 0·015
Postclypeus length (Pcl)	0·28–0·30	0·287 ± 0·008
Left mandible, apical to first marginal (L_A)	0·08–0·09	0·084 ± 0·004
Left mandible, first to third marginal (L_l)	0·14–0·15	0·147 ± 0·004
Left mandible, third marginal to molar (L_m)	0·05–0·06	0·051 ± 0·003
Right mandible, apical to first marginal (R_A)	0·08–0·09	0·085 ± 0·003
Right mandible, first to second marginal (R_l)	0·10–0·11	0·108 ± 0·002
Right mandible, second marginal to molar (R_m)	0·05–0·06	0·056 ± 0·005

The distinguishing features of this species are discussed under the generic heading. It only remains to mention that the abdomen of the worker caste shows no sign of being dehiscent in *A. moretelae*, being without a trace of any line of weakness across the back of the first tergite, and without the slightly humped appearance at this point characteristic of the profile in dehiscent species.

A. moretelae is another of those species names that are included as a result of the observations of Dr A. E. Emerson, since it has been placed hitherto in the genus *Procubitermes* (see also *Adaiphrotermes choanensis*, *Astalotermes brevior*, etc.). A lectotype is designated below from among the syntype series.

Type-material. *Mirotermes* (? *Procubitermes*) *moretelae* Fuller, LECTOTYPE ♂ imago, type-colony, paralectotype ♂ and ♀ imagos, REPUBLIC OF SOUTH AFRICA: Transvaal, The Moretele, Pienaars River, 1.x.1916 (*C. Fuller*, No. F702), in National Collection of Isoptera, Pretoria; other paralectotype in AMNH.

Other material. REPUBLIC OF SOUTH AFRICA: Transvaal, Pretoria (two vials), 1.xi and 6.xi.1945 (*W. G. H. Coaton*); Lichtenburg, (two vials), 1.xi.1960 (*P. C. Joubert & H. P. Nieman*). Orange Free State; Bultfontein, 15.xii and Wesselsbron, 16.xii.1960 (*H. P. Nieman*); Bultfontein, 28.x.1962 (*G. F. Pretorius*); Hoopstad, 25.x.1963 (*W. Mohale*). Cape Province; Vryburg (five vials), 19–21.i.1960 (*P. C. Joubert*).

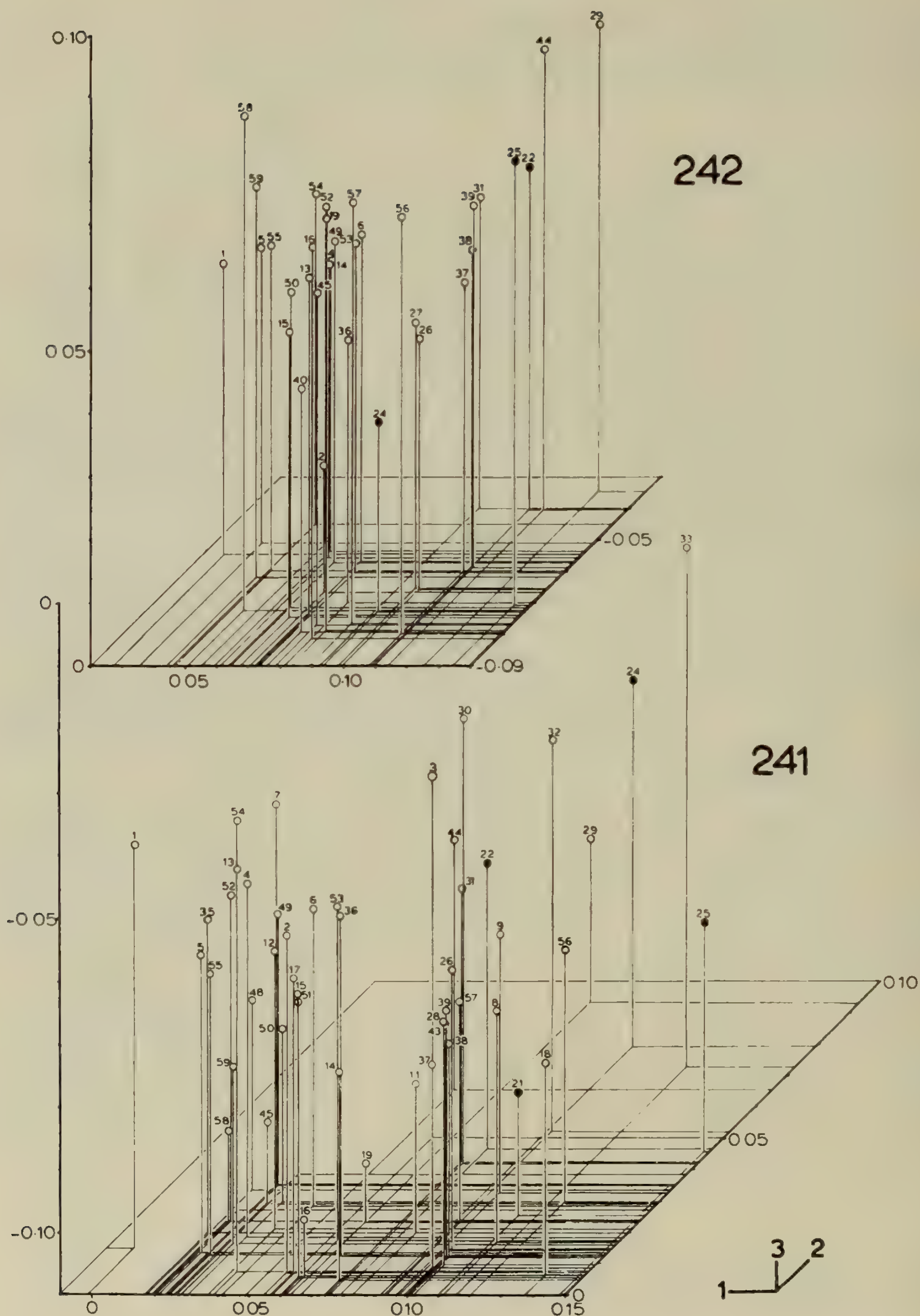
A total of 14 nest-series have been examined. The only biological information is on the type-series which was in the wall of a mound of *Macrotermes natalensis* (Haviland). All the specimens appear to have been collected in the vegetation types 20 or 25 (Keya *et al.*, 1959) inland of the Montane areas (type 6). This contrasts with the smaller number of records of *A. empodius* which was found in type 20 in Natal on the coastal side of the uplands.

ASTRATOTERMES gen. n.

(A—'without, no', stratos, Gr., 'army')

Type-species: *Astratotermes prosenus* sp. n.

Imago. Medium-sized to very large, W, 0·98–1·61. Fore tibia with three apical spurs, third only slightly smaller than other two. Apical teeth of mandibles short to moderately



FIGS 241 & 242. Three-dimensional graphs of canonical variates 1, 2 & 3 showing species of *Astratotermes* as solid spots. 241, imago; 242, worker caste.

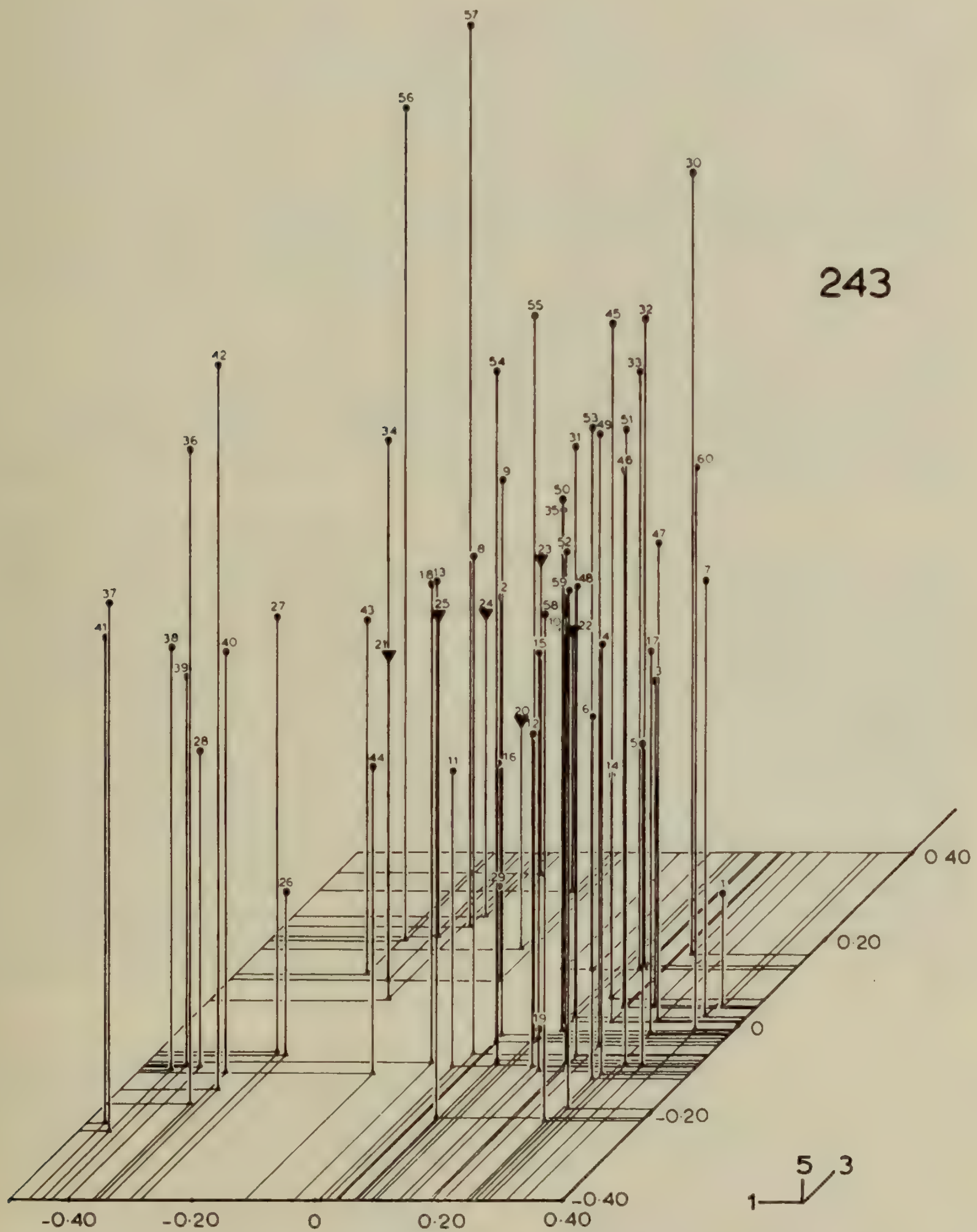


FIG. 243. Three-dimensional graph of principal co-ordinates analysis-plot of eigenvectors 1, 3 & 5 showing species of *Astratotermes* marked by large triangles forming a distinct cluster.

long. L_A/L_1, 0·46–0·80, R_A/R_1, 0·58–1·07; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, to widely clear, separated from molar prominence by distinct notch, complex ratio $L_A/L_1.L_m$, 4·70–11·11. Right mandible with points of apical and marginal teeth more or less in line; anterior edge of first marginal distinctly longer than that of second or approximately equal to it. Meso- and metanota from rather narrow to somewhat wider at constriction M/W, 0·24–0·35, transverse dark sutures always present, sometimes weakly developed; complex ratio of mandible and notal measurements, L_1/M.N, 0·87–2·36.

Worker. Medium-sized to very large, W, 0·78–1·09. Fore tibia slightly swollen or slender, T_1/T_w, 4·54–7·08, with three apical spurs, third spur distinct, never vestigial. Apical teeth of mandibles short to long, L_A/L_1, 0·40–0·88, R_A/R_1, 0·62–1·10; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, to widely clear, separated from molar prominence by deep notch, complex ratio $L_A/L_1.L_m$, 7·47–18·61. Right mandible with apical and marginal teeth in line, or first marginal retracted; anterior edge of first marginal longer than that of second, equal to it, or shorter, complex ratio $R_A/R_1.R_m$, 8·86–21·90. Mesenteric junction with proctodeum varies from diagonal to overlapping by about twice width of mesenteron at insertion of malpighian tubules, proximal end of proctodeum to right of malpighian knot in shorter forms, half-way through it in longer. Enteric valve seating weakly to strongly two- or three-lobed, connected to second pouch of proctodeum by distinct to very long neck, ventral to dorsolateral in position in unopened abdomen; internal cushions of enteric valve scaly, many of scales terminating posteriorly in a single minute spine, none of which protrude through valve opening.

Some species included in this genus appear to be related to some of the species placed in *Astalotermes*, and the only feature in the diagnosis which clearly separates these genera is the presence of small spines in the armature of the enteric valve. There is a considerable spread of variation in other characters such as the imago and worker mandibles, the imago fontanelle, the length of the worker gut as indicated by the position of the enteric valve seating in the unopened abdomen, and in the development of the mixed segment. These suggest that both *Astalotermes* and *Astratotermes* may be artificial assemblages arising from the general similarity of their species in a numerical analysis weighted by the enteric valve structure. However, these two genera are separated from one another by this analysis more widely than some that are homogeneous and easily definable on conventional basis (Text-fig. 243, to be compared with Text-fig. 56). Moreover, attempts to produce genera based on combinations of the characters mentioned above by conventional or purely numerical methods based on measurements alone proved unsuccessful (Text-figs 241, 242). *Astratotermes* is therefore retained, like *Astalotermes*, as a convenient grouping until more ecological and biological information is available.

Astratotermes is distinguishable from *Adaiphrotermes*, *Aderitotermes* and *Anenteotermes* in the worker caste by the short mesenteric overlap with the proctodeum. The workers of *Alyscotermes*, *Amicotermes*, *Apagotermes*, *Ateuchotermes*, *Anaorotermes* and *Asagarotermes* all possess conspicuous and characteristic spiny enteric valve armature. *Aganotermes* and *Adynatotermes* like *Astalotermes* are devoid of even small spines, *Acholotermes* workers have longer apical teeth to the mandibles, and the postclypeus is less inflated. The remaining genera are smaller. In the imago, recognition of the genera is much more difficult. Of the genera with overlapping size-ranges, *Adaiphrotermes* lacks a third apical spur on the fore tibia. *Aganotermes* and *Adynatotermes* have the subsidiary marginal tooth of the left

mandible level with the edge of the molar prominence, not clear of it. Their uneven head-pilosity coupled with longer apical teeth to the mandibles serve to separate *Acholotermes* and *Amicotermes*, since in *Astratotermes* with uneven pilosity, the teeth are shorter. *Astratotermes* with an oval fontanelle cannot be separated in the imago by any constant character from *Alyscotermes* or *Astalotermes*. However, it is usually possible to locate the correct genus by trial and error among the specific keys and descriptions when this difficulty arises; under the generic heading of *Alyscotermes* the separate distinctions species by species are given. *Astratotermes* with a circular fontanelle can be distinguished by its sharp clear outline from *Ateuchotermes* or *Anaorotermes*. Finally, *Aderitotermes* has the ocellus closer to the compound eye and shorter apical mandibular teeth.

Key to Species

Imagos

1 Compound eyes and ocelli proportionately very large and close together, greatest separation between them slightly more than one-third least diameter of ocellus (Text-figs 276–277) . . . . **pacatus** (p. 120)

– Compound eyes and ocelli smaller and separated by at least two-thirds least diameter of ocellus 2

2 Apical teeth of mandibles longer, L_A/L_l, 0·67–0·80, R_A/R_l, 0·92–1·07 . . . 3

– Apical teeth of mandibles shorter, L_A/L_l, 0·53–0·59, R_A/R_l, 0·69–0·76 . . . 4

3 Larger, W, 1·25–1·61. Fontanelle circular, pale and contrasting with head, flat or slightly depressed. Meso- and metanota wider at constriction, M/W, 0·32–0·35. Pilosity of head an even pelt . . . . **prosenus** (p. 122)

– Smaller, W, 1·03–1·06. Fontanelle oval, brown, not contrasting with head, slightly raised. Meso- and metanota narrower at constriction. M/W, 0·24–0·28. Pilosity of head uneven, not forming pelt . . . . **hilarus** (p. 116)

4 Smaller, W, 1·09. Postclypeus less prominently inflated, Pcl/W, 0·25. Fontanelle elongate oval, slightly raised. Ocelli separated from compound eyes by about three-quarters own least diameter, O_w/O–E, 1·31 . . . . **aneristus** (p. 110)

– Larger, W, 1·20–1·28. Postclypeus more prominently inflated, Pcl/W, 0·26–0·28. Fontanelle circular or short oval, flat or slightly depressed. Ocelli separated from compound eyes by approximately own least diameter, O_w/O–E, 0·90–1·08 . . 5

5 Fontanelle large, circular, flat, distinctly paler than head. Apical tooth of left mandible slightly longer, $L_A/L_l.L_m$, 7·53 . . . . . . **mansuetus** (p. 118)

– Fontanelle small, oval, slightly depressed, scarcely paler than head. Apical tooth of left mandible shorter, $L_A/L_l.L_m$, 5·63–6·06 . . . . . **apocnetus** (p. 113)

Workers

1 Apical teeth of mandibles longer, $L_A/L_{\cdot}$, 0·66–0·88, R_A/R_l, 0·85–1·10 . . . 2

– Apical teeth of mandibles shorter, L_A/L_l, 0·40–0·58, R_A/R_l, 0·62–0·75 . . . 4

2 Apical teeth of mandibles shorter, L_A/L_l, 0·66, $R_A/R_{\cdot}$, 0·85. Enteric valve seating ventral in unopened abdomen, joined to second pouch of proctodeum by long (length over three times least width) neck. Fore tibia more inflated, T_l/T_w, 4·96 **mansuetus** (p. 118)

– Apical teeth of mandibles longer, L_A/L_l, 0·71–0·88, $R_A/R_{\cdot}$, 1·00–1·10. Enteric valve seating ventrolateral or lateral, with shorter neck (length about twice least width or less). Fore tibia less inflated, T_l/T_w, 5·06–5·75 3

3 Larger, W, 1·04–1·09. Postclypeus more inflated, Pcl/R_l, 2·38–2·60. Mesenteric junction with proctodeum diagonal, entirely to right of malpighian knot. Enteric

valve seating weakly three lobed. Right mandible with anterior edge of first marginal tooth slightly longer than that of second, proportions of teeth, $R_A/R_1.R_m$, 14·49–14·8 . . . . ***prosenus*** (p. 122)

– Smaller, W, 0·79–0·85. Postclypeus less inflated, Pcl/R_1, 2·00–2·34. Mesenteric overlap with proctodeum, almost twice as long as width of mesenteron at insertion of malpighian tubules, reaching half-way through malpighian knot. Enteric valve seating with two distinct and one smaller lobe. Right mandible with anterior edge of first marginal tooth shorter than that of second, $R_A/R_1.R_m$, 17·3–21·9 . . . . ***hilarus*** (p. 116)

4 Fore tibia more inflated, T_l/T_w, 4·54. Apical teeth of mandibles longer, L_A/L_1, 0·58. Enteric valve seating ventrolateral in unopened abdomen, with three distinct lobes, third only slightly smaller . . . . ***apocnetus*** (p. 113)

– Fore tibia less inflated, T_l/T_w, 5·77–7·08. Apical teeth of mandibles shorter, L_A/L_1, 0·40–0·49. Enteric valve seating dorsolateral to near dorsal, with two distinct lobes, third vestigial or absent 5

5 Mesenteric overlap with protodeum diagonal, entirely to right of malpighian knot ***pacatus*** (p. 120)

– Mesenteric overlap with proctodeum twice as long as width of mesenteron at insertion of malpighian tubules, reaching half-way through malpighian knot ***aneristus*** (p. 110)

Astratotermes aneristus sp. n.

(Text-figs 244, 245, 250, 251 & 256–261; Pl. 2, fig. 1)

Imago. (Queen, colours probably faded.) Head capsule brown, sepia-brown above ocelli; fontanelle only slightly smaller than ocellus, elongate oval, slightly raised, yellow-brown; medial spot oval, about half size of fontanelle, slightly raised, coloured as head; postclypeus yellow-brown, labrum yellow; frontal marks very distinct, slightly depressed yellow-brown crescents; antennae yellow-brown. Pronotum, meso- and metanota yellow-brown, transverse sutures weakly developed; femora pale yellow-brown, tibiae and tarsi yellow. Abdominal tergites yellow-brown with darker dorsal stigmata, ventral stigmata, and sternites pale yellow-brown, paler in middle; cerci yellow.

Posterior margin of head capsule not quite evenly rounded, slightly undulating; ocelli medium sized, separated from compound eyes by three-quarters own least diameter; postclypeus weakly inflated, Pcl/W, 0·25, posterior margin broadly arched, median suture distinct. Apical teeth of mandibles short, L_A/L_1, 0·53, R_A/R_1, 0·70; subsidiary marginal tooth of left mandible widely separated from molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 6·00; points of apical and marginal teeth of right mandible approximately in line, anterior edge of first marginal slightly shorter than that of second. Meso- and metanota moderately wide at constriction, M/W, 0·30. Pilosity of head capsule, yellow-brown, short setae rather even, almost forming a pelt, obscured by numerous uneven emergent setae.

Measurements (one specimen) in millimetres.

Head width across eyes (W) . .	1·09
Ocellus ($O_w \times O_l$) . . .	0·08 × 0·13
Ocellus to eye (O–E) . . .	0·06
Postclypeus length (Pcl) . .	0·27
Antennal article III . . .	0·05
Antennal article IV . . .	0·07
Antennal article V . . .	0·07
Left mandible, apical to first marginal (L_A)	0·09
Left mandible, first to third marginal (L_1)	0·17

FIGS 244–255. *Astratotermes*, imago head capsules, front and side views, and imago mandibles. 244, 245 & 250, 251, *A. aneristus*; 246, 247 & 252, 253, *A. apocnetus*; 248, 249 & 254, 255, *A. hilarus*.

Left mandible, third marginal to molar (L_m)	0·09
Right mandible, apical to first marginal (R_A)	0·09
Right mandible, first to second marginal (R_1)	0·13
Right mandible, second marginal to molar (R_m)	0·08
Mesonotum width (M)	0·33
Metanotum width (N)	0·33

Worker. Head-capsule and pilosity, pale yellow, setae very sparse and scattered, inconspicuous. Postclypeus moderately inflated, Pcl/W, 0·27, Pcl/R_1, 2·02. Apical teeth of mandibles short, L_A/L_1, 0·48, R_A/R_1, 0·67; subsidiary marginal tooth of left mandible separated from molar prominence by wide deep notch in surface view, complex ratio $L_A/L_1.L_m$, 7·70; apical and marginal teeth of right mandible approximately in line, anterior edges of first and second marginals equal, $R_A/R_1.R_m$, 11·96. Fore tibia very slender, T_l/T_w, 6·02, third apical spur distinct, half length of other two. Mesenteric overlap at junction with proctodeum about twice as long as width of mesenteron at insertion of malpighian tubules, proctodeum reaching half-way through malpighian knot; enteric valve seating slightly dorso-lateral in unopened abdomen, with two distinct lateral lobes and vestigial third, inner lobe, connected to second pouch of proctodeum by pronounced neck; membranous wall of valve beyond cushions with very sparse minute spicules.

Measurements (one specimen) in millimetres.

Head width (W)	0·85
Fore tibia width (T_w)	0·11
Fore tibia length (T_l)	0·66
Postclypeus length (Pcl)	0·23
Left mandible, apical to first marginal (L_A)	0·07
Left mandible, first to third marginal (L_1)	0·15
Left mandible, third marginal to molar (L_m)	0·06
Right mandible, apical to first marginal (R_A)	0·08
Right mandible, first to second marginal (R_1)	0·11
Right mandible, second marginal to molar (R_m)	0·06

The slight tendency in *A. aneristus* for the first marginal tooth of the right mandible to be reduced, and the beginnings of a mixed segment in the gut suggest weak affinities with *Anenteotermes*. Similar tendencies are also found in other genera such as *Astalotermes* and *Acholotermes*, but the species concerned, *A. brevior* and *A. epius*, both have differently proportioned mandibular teeth from *A. aneristus*. Of the other species of *Astratotermes*, *A. apocnetus* is distinguishable in the imago by its smaller fontanelle, smaller ocelli further from the eyes, and more inflated postclypeus; the worker has a short mesenteric-proctodeal junction, to the right of the malpighian knot, and a prominently three-lobed enteric valve seating ventro-lateral in position in the unopened abdomen. *A. hilarus* has longer apical teeth to the mandibles. *A. mansuetus* is larger, with more inflated postclypeus, a large circular fontanelle, and in the worker, a ventral enteric valve seating with three

prominent lobes. The large eyes and ocelli of *A. pacatus* are distinctive, and the subsidiary tooth of the left mandible is only just clear of the molar plate. The type-species, *A. prosenus*, is very large, with a circular pale fontanelle and longer apical mandibular teeth. The worker abdomen of *A. aneristus* is not dehiscent.

Holotype ♀ imago (queen) and six paratype workers from type-colony only, ZAMBIA: Kitwe, 23.i.1957 (*W. G. H. Coaton*) in National Collection of Isoptera, No. TM.3927, Pretoria.

Only the type nest-series is known, and there is no information on its biology.

Astratotermes apocnetus sp. n.

(Text-figs 246, 247, 252, 253 & 262–267)

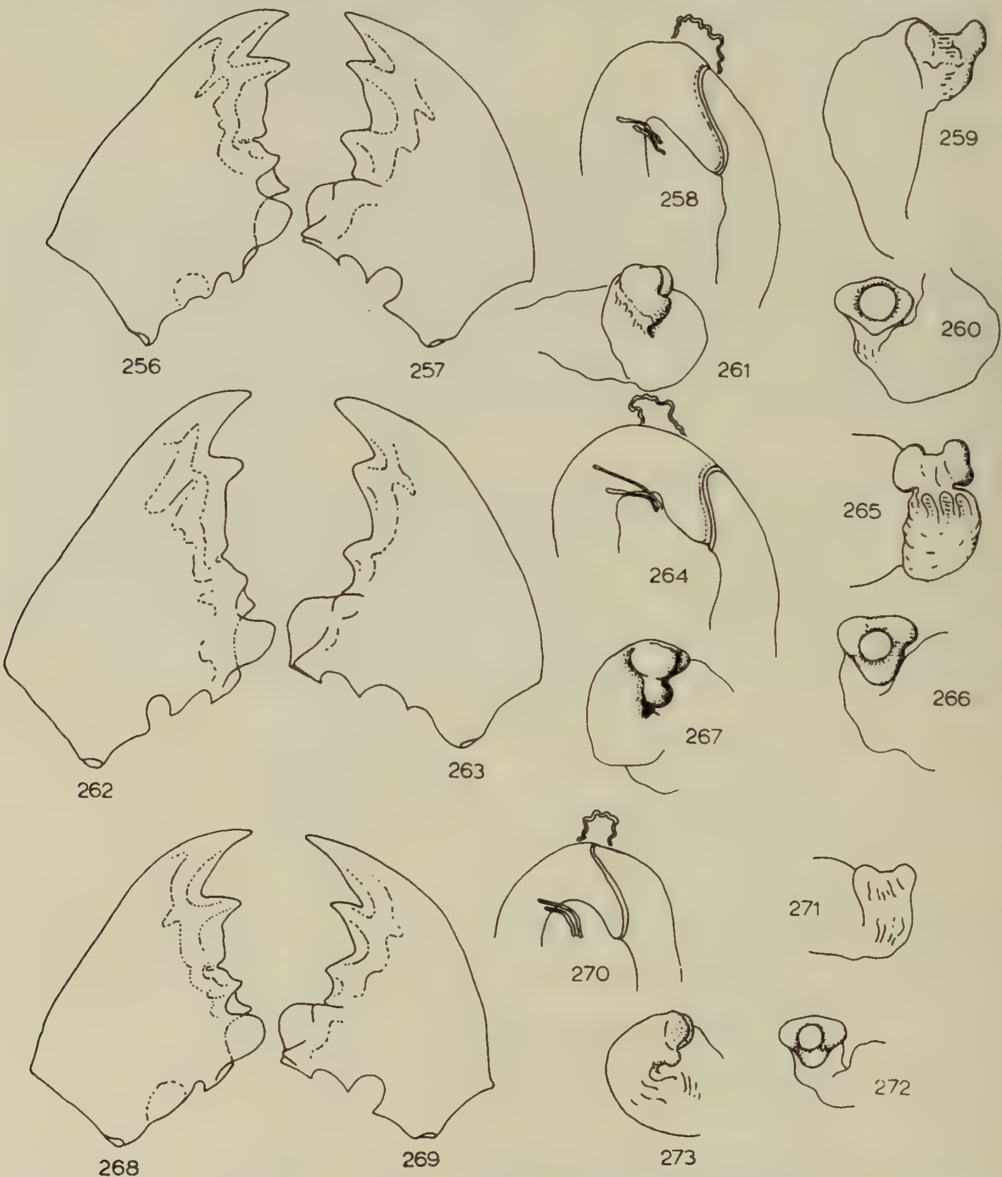
Imago. Head capsule very dark chestnut-brown, pitch-black above ocelli; fontanelle less than half size of ocellus, somewhat irregular oval, slightly depressed or ridged in middle, dark chestnut-brown, medial spot same size as fontanelle, slightly raised or nearly flat, short oval, coloured as head; postclypeus sepia-brown, labrum yellow-brown, frontal marks distinct, somewhat depressed, semicircular, dark chestnut-brown; antennae brown. Pronotum dark sepia-brown, meso- and metanota chestnut-brown, transverse dark sutures distinct; legs, femora sepia-brown, tibiae yellow-brown, tarsi yellow. Abdominal tergites and dorsal stigmata sepia-brown, ventral stigmata and lateral parts of sternites brown, middle of sternites paler; cerci yellow.

Posterior margin of head capsule evenly rounded; ocelli rather small, separated from compound eyes by approximately own least diameter; postclypeus moderately inflated, Pcl/W, 0·27–0·28, posterior margin evenly rounded, median suture very distinct. Apical teeth of mandibles short, L_A/L_1, 0·49–0·66, R_A/R_1, 0·69–0·70; subsidiary marginal tooth of left mandible widely separated from molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 5·63–6·06; point of first marginal tooth of right mandible slightly behind line from apical to second marginal, anterior edges of marginal teeth approximately equal in length. Meso- and metanota moderately wide at constriction, M/W, 0·30–0·31. Pilosity of head capsule brown, uneven, no pelt.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W) .	1·20–1·28
Ocellus ($O_w \times O_l$) . . .	0·08–0·09 × 0·10–0·11
Ocellus to eye (O–E) . .	0·08–0·09
Postclypeus length (Pcl) . .	0·33–0·36
Antennal article III . . .	0·05–0·06
Antennal article IV . .	0·06
Antennal article V . . .	0·06–0·07
Left mandible, apical to first marginal (L_A) . . .	0·12
Left mandible, first to third marginal (L_1)	0·21–0·23
Left mandible, third marginal to molar (L_m)	0·09–0·10
Right mandible, apical to first marginal (R_A) . . .	0·12–0·13
Right mandible, first to second marginal (R_1) . . .	0·17–0·18
Right mandible, second marginal to molar (R_m) . . .	0·09
Mesonotum width (M) . .	0·37–0·39
Metanotum width (N) . .	0·36–0·41

Worker. Head capsule pale yellow, pilosity fairly numerous, rather short, yellow. Postclypeus weakly inflated, Pcl/W, 0·24, Pcl/R_l, 1·73. Apical teeth of mandibles short, L_A/L_l, 0·58, R_A/R_l, 0·75; subsidiary marginal tooth of left mandibles separated from molar prominence by wide deep notch in surface view, complex ratio $L_A/L_l.L_m$, 9·10; first marginal tooth of right mandible distinctly behind line of apical to first marginal, anterior edge of first marginal shorter



Figs 256–273. *Astratotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seatings. 256–261, *A. aneristus*; 262–267, *A. apocnetus* (mandibles rather worn); 268–273, *A. hilarus*.

than that of second, $R_A/R_l.R_m$, 11·91. Fore tibia scarcely inflated, T_l/T_w, 4·54, third apical spur about half length of other two but pale, inconspicuous. Mesenteric overlap with proctodeum diagonal or slightly less, to right of malpighian knot; enteric valve seating ventrolateral in unopened abdomen, distinctly three-lobed, third inner lobe slightly smaller, connected to second pouch of proctodeum by distinct neck; membranous wall of valve beyond cushions without detectable spicules.

Measurements (one specimen)in millimetres.

Head width (W)	1·00
Fore tibia width (T_w)	0·16
Fore tibia length (T_l)	0·74
Postclypeus length (Pcl)	0·24
Left mandible, apical to first marginal (L_A)	0·10
Left mandible, first to third marginal (L_l)	0·18
Left mandible, third marginal to molar (L_m)	0·06
Right mandible, apical to first marginal (R_A)	0·10
Right mandible, first to second marginal (R_l)	0·14
Right mandible, second marginal to molar (R_m)	0·06

The features distinguishing *A. apocnetus* from *A. aneristus* have been given under that species. *A. hilarus* has a larger fontanelle, shorter postclypeus and longer apical teeth to the mandibles in the imago. The worker also has longer apical teeth and a longer mesenteric proctodeal overlap. In *A. mansuetus* the fontanelle is large, circular and flat, and the mandibles slightly different in proportions in the imago; the worker has longer apical teeth, and the subsidiary marginal of the left mandible is only just clear of the molar prominence. *A. pacatus* is distinguishable by the large eyes and ocelli of the imago, and by the slender fore tibia, two-lobed enteric valve-seat, and differently proportioned mandibles of the worker. *A. prosenus* is larger, with longer apical teeth in both castes. The imago also has a pale fontanelle and even pilosity, and the worker a slender fore tibia. Outside *Astratotermes*, *Astalotermes irrixosus* was at first thought to be the same species. However, in the imago, the proportions of mandibular teeth are slightly different, the ocellus is closer to the eye and the meso- and metanota are proportionately slightly wider. In the worker, apart from the unarmed enteric valve, the fore tibia has a vestigial third spur and is distinctly thinner, the mesenteric overlap is longer, and the enteric valve seat dorsolateral. The abdomen of the worker caste is dehiscent in *A. apocnetus*.

Holotype ♀ imago, paratype ♀ and ♂ imagos, and workers from type-colony, KENYA: Kisumu, 13.viii.1940 (*E. E. Haviland* coll. No. T3) in American Museum of Natural History. (Paratype ♀ and ♂ imago and worker from type-colony also in BMNH.)

Only the type-series is known, and there is no information on its biology.

Astratotermes hilarus sp. n.

(Text-figs 248, 249, 254, 255 & 268–273; Pl. 2, fig. 2)

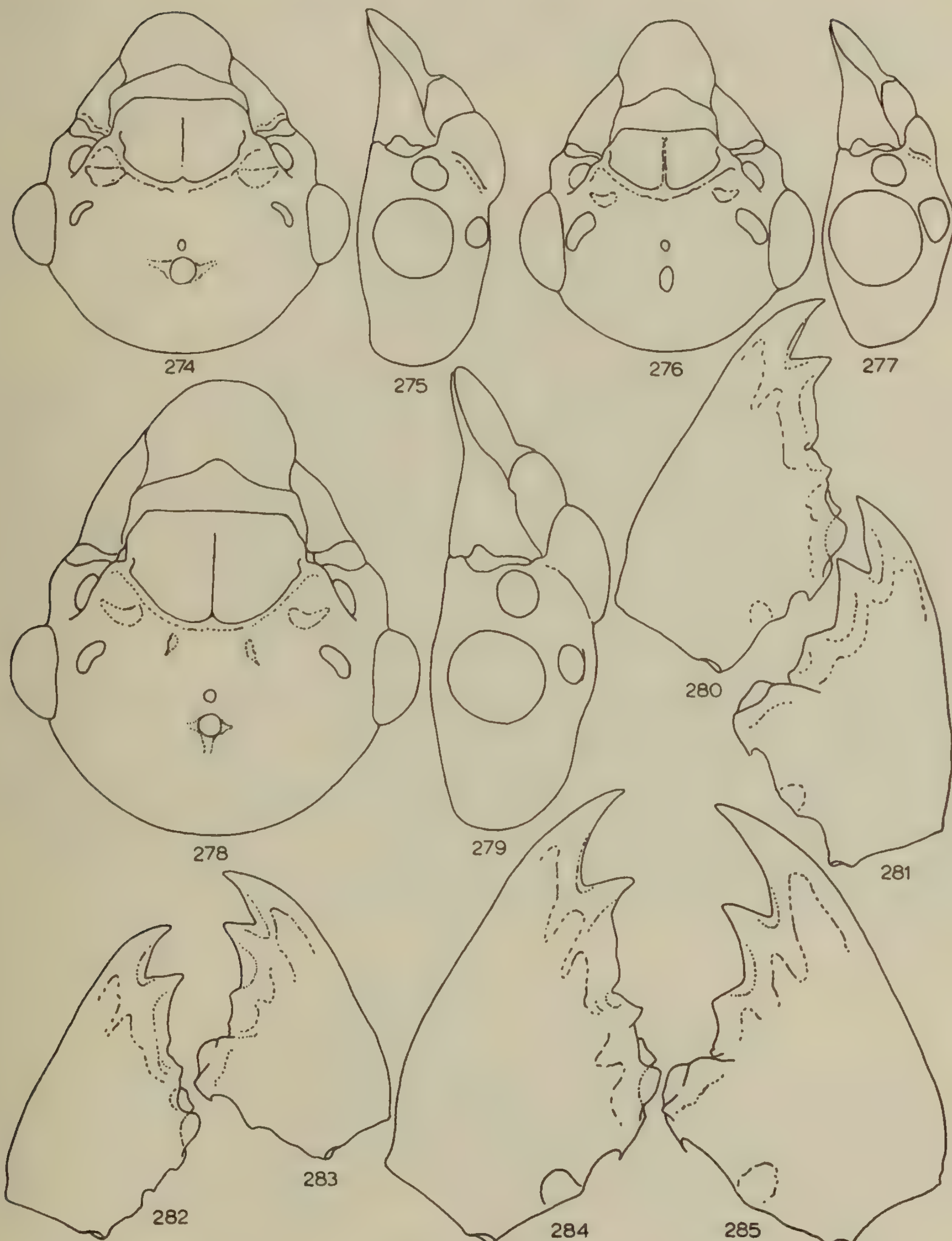
Imago. (Queens and kings only available, colours may be faded.) Head capsule chestnut-brown, darker above ocelli; fontanelle nearly same size as ocellus, slightly raised, short oval, brown; medial spot very small, slightly raised, circular, coloured as head; postclypeus brown, labrum yellow; frontal marks indistinct flat brown crescents; antennae brown. Pronotum, meso- and metanota brown, transverse dark sutures very distinct; legs, femora pale brown, tibia yellow-brown, tarsi yellow. Abdominal tergites and dorsal stigmata brown, ventral stigmata and sternites pale brown laterally, yellow in middle; cerci pale yellow-brown.

Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by two-thirds up to own least diameter, postclypeus weakly inflated, Pcl/W, 0·21–0·24, posterior margin arched, not evenly rounded, median suture weakly developed. Apical teeth of mandibles moderately long, L_A/L_1, 0·67–0·80, R_A/R_1, 0·95–1·07; subsidiary marginal tooth of left mandible widely separated from molar prominence in surface view, L_A/L_1 L_m, 10·07–11·11; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edges of marginal teeth approximately equal. Meso- and metanota rather narrow at constriction, M/W, 0·24–0·28. Pilosity of head capsule brown, uneven, no pelt.

Measurements (five specimens from three nest-series) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	1·03–1·06	1·041 ± 0·016
Ocellus ($O_w \times O_l$)	0·07–0·10 × 0·10–0·12	0·084 ± 0·010 × 0·113 ± 0·009
Ocellus to eye (O–E)	0·06–0·09	0·067 ± 0·010
Postclypeus length (Pcl)	0·23–0·25	0·240 ± 0·011
Antennal article III	0·04–0·05	0·047 ± 0·003
Antennal article IV	0·05–0·06	0·051 ± 0·004
Antennal article V	0·05–0·06	0·056 ± 0·004
Left mandible, apical to first marginal (L_A)	0·11–0·12	0·115 ± 0·004
Left mandible, first to third marginal (L_1)	0·15–0·17	0·159 ± 0·007
Left mandible, third marginal to molar (L_m)	0·06–0·07	0·068 ± 0·004
Right mandible, apical to first marginal (R_A)	0·11–0·12	0·115 ± 0·003
Right mandible, first to second marginal (R_1)	0·11–0·12	0·113 ± 0·003
Right mandible, second marginal to molar (R_m)	0·07–0·08	0·074 ± 0·002
Mesonotum width (M)	0·25–0·30	0·269 ± 0·019
Metanotum width (N)	0·26–0·30	0·275 ± 0·018

Worker. Head capsule pale yellow, pilosity rather sparse but strong and conspicuous, yellow. Postclypeus moderately inflated, Pcl/W, 0·25–0·29, Pcl/R_1, 2·00–2·34. Apical teeth of mandibles long, L_A/L_1, 0·80–0·88, R_A/R_1, 1·04–1·10; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, $L_A/L_1.L_m$, 16·42–18·61; first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal shorter than that of second, $R_A/R_1.R_m$, 17·30–21·90. Fore tibia slender, T_l/T_w, 5·06–5·75, third apical spur distinct, about half length of other two. Mesenteric overlap with proctodeum about twice as long as width of mesenteron at insertion of malpighian tubules, proctodeum reaching half-way through malpighian knot; enteric valve seating ventrolateral in unopened abdomen, rather weakly three-lobed, third lobe smaller, connected to second pouch



Figs 274–285. *Astratotermes*, imago head capsules, front and side views, and imago mandibles. 274, 275 & 280, 281, *A. mansuetus* ♂; 276, 277 & 282, 283, *A. pacatus*; 278, 279 & 284, 285, *A. prosenus*.

of proctodeum by distinct neck. Membranous wall of valve beyond cushions without detectable spicules.

Measurements (three specimens from three nest-series) in millimetres.

	Range	Mean
Head width (W)	0·79–0·85	0·812
Fore tibia width (T_w)	0·10–0·11	0·107
Fore tibia length (T_l)	0·57–0·58	0·574
Postclypeus length (Pcl)	0·20–0·23	0·219
Left mandible, apical to first marginal (L_A) . .	0·10–0·11	0·105
Left mandible, first to third marginal (L_l) . .	—	0·126
Left mandible, third marginal to molar (L_m) .	0·04–0·05	0·047
Right mandible, apical to first marginal (R_A) .	0·01–0·11	0·105
Right mandible, first to second marginal (R_l) .	—	0·099
Right mandible, second marginal to molar (R_m) .	0·05–0·06	0·055

Comparisons of *A. hilarus* with *A. aneristus* and *A. apocnetus* have already been made under those species-headings. In *A. mansuetus* the imago is distinguished by its large fontanelle, more inflated postclypeus, and shorter mandibular apical teeth. The latter feature also applies to the worker in which the anterior edges of right first and second marginals are approximately equal. The enteric valve seating has a very long neck in this species. In *A. pacatus* the large eyes and ocelli characterize the imago which, like the worker, has shorter apical teeth. The enteric valve seating is two-lobed and dorsal in *A. pacatus* workers. *A. prosenus* is again easily recognized by its large size, pale fontanelle, even pilosity, and, in the worker, its short mesenteric overlap with the proctodeum. The worker abdomen appears dehiscent in *A. hilarus*.

Holotype ♀ imago (queen), paratype ♂ (king) and workers from type-colony, Democratic Republic of Congo: Katanga, Keyberg, 21.iv.1948 (*A. E. Emerson*) in American Museum of Natural History.

Other paratype material: Democratic Republic of Congo: Katanga, Keyberg (two vials), 21 & 25.iv.1948 (*A. E. Emerson*), in AMNH. (One paratype queen and worker also in BMNH.)

The three known nest-series, all from the same locality, were recorded from the mounds of *Cubitermes* sp. and *Trinervitermes* sp. in savanna woodland.

Astratotermes mansuetus sp. n.

(Text-figs 274, 275, 280, 281 & 286–291; Pl. 2, fig. 4)

Imago. Head capsule sepia-brown, darker above ocelli; fontanelle slightly smaller than ocellus, circular, flat, pale yellow-brown; medial spot circular, less than half size of fontanelle, slightly raised, brown; postclypeus brown, labrum yellow; frontal marks distinct, flat, semicircular, brown; antennae very pale yellow-brown. Pronotum, meso- and metanota brown, transverse dark sutures present but not distinct; legs, femora pale yellow-brown, tibiae paler, tarsi yellow-white. Abdominal tergites pale brown, dorsal stigmata paler, sternites yellow-brown, ventral stigmata pale; cerci yellow-white.

Posterior margin of head capsule not quite evenly rounded, slightly undulating behind eyes; ocelli medium-sized, separated from compound eyes by about own least diameter; postclypeus moderately inflated, Pcl/W, 0·26, posterior margin evenly rounded, median suture present. Apical teeth of mandibles short, L_A/L_l, 0·59, R_A/R_l, 0·76; subsidiary marginal tooth of left

mandible separated from molar prominence by distinct notch in surface view, complex ratio, $L_A/L_1.L_m$, 7·53; points of apical and marginal teeth of right mandible approximately in line, anterior edges of first and second marginals nearly equal. Meso- and metanota moderately wide at constriction, M/W, 0·30. Pilosity of head capsule pale brown, rather even, almost a pelt with longer emergent setae.

Measurements (one specimen) in millimetres.

Head width across eyes (W)	1·21
Ocellus ($O_w \times O_l$)	0·09 × 0·13
Ocellus to eye (O–E)	0·09
Postclypeus length (Pcl)	0·31
Antennal article III	0·05
Antennal article IV	0·06
Antennal article V	0·06
Left mandible, apical to first marginal (L_A)	0·11
Left mandible, first to third marginal (L_1)	0·18
Left mandible, third marginal to molar (L_m)	0·08
Right mandible, apical to first marginal (R_A)	0·10
Right mandible, first to second marginal (R_1)	0·14
Right mandible, second marginal to molar (R_m)	0·08
Mesonotum width (M)	0·37
Metanotum width (N)	0·38

Worker. Head capsule yellow-white, pilosity very sparse, inconspicuous pale yellow; postclypeus moderately inflated, Pcl/W, 0·30, Pcl/R_1, 2·45. Apical teeth of mandibles fairly short, L_A/L_1, 0·66, R_A/R_1, 0·85; subsidiary marginal tooth of left mandibles just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 9·95; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edges of first and second marginals approximately equal, $R_A/R_1.R_m$, 12·85. Fore tibia scarcely swollen, T_l/T_w, 4·96, third apical spur small but clearly present, not vestigial. Mesenteric overlap at junction with proctodeum diagonal, to right of malpighian knot; enteric valve seating ventral in unopened abdomen, with three pronounced lobes, third lobe slightly smaller, attached to second pouch of proctodeum by very long neck; membranous wall of valve beyond cushions with minute spicules.

Measurements (one specimen) in millimetres.

Head width (W)	0·95
Fore tibia width (T_w)	0·15
Fore tibia length (T_l)	0·73
Postclypeus length (Pcl)	0·29
Left mandible, apical to first marginal (L_A)	0·10
Left mandible, first to third marginal (L_1)	0·15
Left mandible, third marginal to molar (L_m)	0·07
Right mandible, apical to first marginal (R_A)	0·10
Right mandible, first to second marginal (R_1)	0·12
Right mandible, second marginal to molar (R_m)	0·07

Comparisons have already been made between *A. mansuetus* and *A. aneristus*, *A. apocnetus* and *A. hilarus*. The large eyes and ocelli that characterize *A. pacatus* in the imago have also been mentioned. In the worker caste this species differs from *A. mansuetus* in having a very slender fore tibia, shorter mandibular apical teeth, and a two-lobed dorsal enteric valve seating. *A. prosenus* has longer apical teeth in both castes; the worker caste also has a more slender fore tibia, and a shorter-necked enteric valve seating. In the few specimens of the worker caste of *A. mansuetus* that are available there is no sign of abdominal dehiscence.

Holotype ♂ imago, paratype ♂ and workers from type-colony, KENYA: 4 miles from Kaptagat on Eldoret Road, 13.v.1954 (*R. M. C. Williams* Coll. No. RW43) in British Museum (Natural History).

The single type-nest-series was found in a mound of *Cubitermes* sp.

Astratotermes pacatus (Silvestri) **comb. n.**

(Text-figs 276, 277, 282, 283 & 292–297; Pl. 2, fig. 3)

Anoplotermes pacatus Silvestri, 1914 : 54. LECTOTYPE ♀, GUINEA: Kindia. (Silvestri Coll., Istituto di Entomologia Agraria, Naples) here designated [examined].

Anoplotermes sedatus Silvestri, 1914 : 55. LECTOTYPE ♀, CONGO (BRAZZAVILLE): Brazzaville. (Silvestri Coll., Istituto di Entomologia Agraria, Naples) here designated [examined]. **Syn. n.**

Imago. Head capsule sepia-brown, not darker above ocelli; fontanelle medium-sized, but less than half as large as ocelli, oval, flat, pale brown; medial spot very small, almost obsolete broad oval, brown; postclypeus brown, labrum yellow; frontal marks small, flat, semicircular, brown, antennae brown. Pronotum sepia-brown, meso- and metanota brown, transverse sutures present, legs, femora yellow-brown, tibiae paler, tarsi yellow. Abdominal tergites sepia-brown, dorsal stigmata pale yellow-brown, ventral stigmata similar, sternites pale brown laterally, paler middle, cerci yellow.

Posterior margin of head capsule widely arched, slightly undulating; ocelli and compound eyes large, separated by up to one-third least diameter of ocellus; postclypeus weakly inflated, Pcl/W, 0·19–0·23, posterior margin arched or sinuate, not evenly rounded, median suture present, not always complete. Apical teeth of mandibles short, L_A/L_1, 0·46–0·60, R_A/R_1, 0·58–0·78; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 4·70–8·11, points of apical and marginal teeth of right mandible approximately in line, anterior edge of first marginal nearly twice length of second. Meso- and metanota moderately wide at constriction, M/W, 0·29–0·32. Pilosity of head capsule close and even, forming a pelt with longer emergent setae.

Measurements (seven specimens from four localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	0·98–1·21	1·062 ± 0·090
Ocellus ($O_w \times O_l$)	0·11–0·14 × 0·14–0·19	0·118 ± 0·013 × 0·154 ± 0·015
Ocellus to eye (O–E)	0·02–0·04	0·030 ± 0·006
Postclypeus length (Pcl)	0·21–0·23	0·226 ± 0·007
Antennal article III	0·04–0·07	0·050 ± 0·011
Antennal article IV	0·05–0·08	0·060 ± 0·011
Antennal article V	0·05–0·08	0·059 ± 0·010
Left mandible, apical to first marginal (L_A)	0·08–0·09	0·085 ± 0·003

Left mandible, first to third marginal (L_1) . . .	0·14–0·19	0·160 ± 0·021
Left mandible, third marginal to molar (L_m)	0·07–0·10	0·080 ± 0·011
Right mandible, apical to first marginal (R_A) . . .	0·08–0·09	0·085 ± 0·005
Right mandible, first to second marginal (R_1) . . .	0·11–0·15	0·125 ± 0·016
Right mandible, second marginal to molar (R_m) . . .	0·06–0·09	0·077 ± 0·011
Mesonotum width (M) . .	0·29–0·39	0·321 ± 0·039
Metanotum width (N) . .	0·30–0·40	0·341 ± 0·032

Worker. Head capsule yellow-white, pilosity sparse, yellow. Postclypeus weakly to moderately inflated, Pcl/W, 0·22–0·29, Pcl/R_1, 1·65–2·38. Apical teeth of mandibles short, L_A/L_1, 0·40–0·49, R_A/R_1, 0·62–0·71; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 7·47–9·56; apical and marginal teeth of right mandible approximately in line, anterior edges of first and second marginals equal, $R_A/R_1.R_m$, 8·86–13·92. Fore tibia very slender, T_1/T_w, 5·77–7·08, third apical spur distinct. Mesenteric overlap at junction with proctodeum diagonal, to right of malpighian knot; enteric valve seating dorsal on right hand side of unopened abdomen, distinctly two-lobed, connected to second pouch of proctodeum by short neck; membranous wall of valve beyond cushions with minute spicules.

Measurements (three specimens from three localities) in millimetres.

	Range	Mean
Head width (W)	0·78–0·93	0·850
Fore tibia width (T_w)	0·09–0·12	0·110
Fore tibia length (T_1)	0·56–0·85	0·704
Postclypeus length (Pcl)	0·19–0·25	0·215
Left marginal, apical to first marginal (L_A) . .	0·07–0·08	0·073
Left mandible, first to third marginal (L_1) . .	0·14–0·19	0·161
Left mandible, third marginal to molar (L_m) . .	0·05–0·06	0·055
Right mandible, apical to first marginal (R_A) .	0·07–0·08	0·073
Right mandible, first to second marginal (R_1) .	0·11–0·13	0·113
Right mandible, second marginal to molar (R_m) .	0·05–0·07	0·057

The characters that distinguish *A. pacatus* from *A. aneristus*, *A. apocnetus*, *A. hilarus* and *A. mansuetus* have already been given under those species. There only remains the type-species of the genus, *A. prosenus*, to be compared. This is larger than *A. pacatus*, with proportionately smaller eyes and ocelli, longer mandibular apical teeth, and differently proportioned marginals on the right. It also has a circular pale fontanelle. The worker of *A. prosenus* also has longer apical teeth, more inflated postclypeus, and a slightly thicker fore tibia. The abdomen of the worker caste is dehiscent in *A. pacatus*.

Lectotypes have been designated from the existing syntype material of *A. pacatus* (Silvestri) and *A. sedatus* (Silvestri) as indicated below.

Type-material. *Anoplotermes pacatus* Silvestri, LECTOTYPE ♀ imago, paralectotype ♂ imagos and workers from type-colony, GUINEA: Kindia, 10°N., 12°45′W., 21.viii.1912 (*F. Silvestri*), in Silvestri Coll., Istituto di Entomologia Agraria, Portici, Naples. *Anoplotermes sedatus* Silvestri, LECTOTYPE ♀ imago, paralectotype ♂

and ♀ imagos from type-colony, CONGO: Brazzaville (*J. Weiss*), in Silvestri Coll., Istituto di Entomologia Agraria, Portici, Naples.

Other material. GUINEA: Mount Nimba (*M. Lamotte*) in AMNH and BMNH. DEMOCRATIC REPUBLIC OF CONGO: Yangambi, 29.v.1948, Camp Putnam, Epulu R., v.1948 (*A. E. Emerson*) in AMNH.

There is no biological information relating to the five known nest-series.

Astratotermes prosenus sp. n.

(Text-figs 278, 279, 284, 285 & 298–303; Pl. 2, fig. 5)

Imago. Head capsule brown to sepia-brown, darker above ocelli, dark areas often extending as tapering streaks converging to fontanelle; fontanelle fairly large, a little smaller than ocelli, circular or slightly broader than long, sometimes irregular outline, flat or slightly depressed, yellow-white to pale yellow-brown; medial spot circular, flat, smaller than fontanelle, brown; postclypeus yellow-brown, labrum yellow; frontal marks weakly developed, flat crescent, pale yellow-brown to brown; antennae yellow to pale yellow-brown. Pronotum, meso- and metanota brown, transverse sutures distinct; femora yellow-brown, tibiae paler, tarsi yellow, Abdominal tergites brown, dorsal stigmata and sternites, pale brown, sternites paler in middle, ventral stigmata pale; cerci yellow.

Posterior margin of head capsule usually evenly though somewhat broadly rounded; ocelli medium-sized, separated from compound eyes by approximately own least diameter; postclypeus weakly to moderately inflated, Pcl/W, 0·23–0·27, posterior margin arched, median suture distinct. Apical teeth of mandibles fairly long, L_A/L_1, 0·68–0·78, R_A/R_1, 0·92–1·06; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio $L_A/L_1.L_m$, 6·34–8·90; points of apical and marginal teeth of right mandible in line, anterior edge of first marginal slightly longer than that of second. Meso- and metanota moderately wide at constriction, M/W, 0·32–0·35. Pilosity of head capsule yellow-brown, rather sparse slightly uneven pelt with emergent setae.

Measurements (six specimens from three localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	1·25–1·61	1·394 ± 0·135
Ocellus ($O_w \times O_l$)	0·09–0·13 × 0·11–0·19	0·106 ± 0·014 × 0·145 ± 0·028
Ocellus to eye (O–E)	0·09–0·13	0·104 ± 0·014
Postclypeus length (Pcl)	0·33–0·38	0·352 ± 0·023
Antennal article III	0·04–0·08	0·057 ± 0·011
Antennal article IV	0·06–0·09	0·074 ± 0·008
Antennal article V	0·07–0·09	0·075 ± 0·008
Left mandible, apical to first marginal (L_A)	0·14–0·18	0·153 ± 0·016
Left mandible, first to third marginal (L_1)	0·19–0·25	0·215 ± 0·026
Left mandible, third marginal to molar (L_m)	0·09–0·11	0·094 ± 0·007
Right mandible, apical to first marginal (R_A)	0·13–0·18	0·159 ± 0·019
Right mandible, apical to first marginal (R_A)	0·15–0·18	0·159 ± 0·016

FIGS 286–303. *Astratotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seatings. 286–291, *A. mansuetus*; 292–297, *A. pacatus*; 298–303, *A. prosenus*.

Right mandible, second marginal to molar (R_m) . . .	0·08–0·11	0·094 ± 0·015
Mesonotum width (M) . .	0·43–0·53	0·464 ± 0·034
Metanotum width (N) . .	0·39–0·56	0·441 ± 0·059

Worker. Head capsule pale yellow, pilosity sparse and long, yellow. Postclypeus moderately inflated, Pcl/W, 0·29–0·31, Pcl/R_1, 2·38–2·60. Apical teeth of mandibles fairly long, L_A/L_1, 0·71–0·79, R_A/R_1, 1·00–1·02; subsidiary marginal teeth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio, $L_A/L_1.L_m$, 11·40–12·55; apical and marginal teeth approximately in line, anterior edge of first marginal distinctly longer than that of second, $R_A/R_1.R_m$, 14·49–14·80. Fore tibia scarcely inflated, Tl/Tw, 5·33–5·42, third apical spur distinct, about half length of other two. Mesenteric overlap at junction with proctodeum diagonal, to right of malpighian knot; enteric valve seating lateral in unopened abdomen, very weakly three-lobed, connected to second pouch of proctodeum by short neck; membranous wall of valve beyond cushions with sparse minute spicules.

Measurements (three specimens from three localities) in millimetres.

	Range
Head width (W)	1·04–1·09
Fore tibia width (T_w)	0·15
Fore tibia length (T_l)	0·80–0·81
Postclypeus length (Pcl)	0·31–0·33
Left mandible, apical to first marginal (L_A) .	0·13–0·14
Left mandible, first to third marginal (L_1) .	0·18
Left mandible, third marginal to molar (L_m) .	0·06
Right mandible, apical to first marginal (R_A) .	0·13
Right mandible, first to second marginal (R_1) .	0·13
Right mandible, second marginal to molar (R_m)	0·07

All the necessary comparisons between *A. prosenus* and other members of the genus have already been made in their individual descriptions. *Astratotermes prosenus* has been made the type-species of the genus because it is the species most distinct from related genera, and so least likely to sink in synonymy should adjustments be needed in their membership in future. The abdomen of the worker caste appears at least potentially dehiscent in *A. prosenus*.

Holotype ♀ imago, paratype ♂ and ♀ imagos, and workers from type-colony. NIGERIA: Northern Region, 30 miles from Lokoja on Okene Road, 8.iii.1958 (*W. A. Sands* Coll. No. S.2081) in British Museum (Natural History).

Other paratype material. NIGERIA: Northern Region, 6 m. from Gombe on Dadin Kowa Road, 9.v.1957 and Samaru Regional Research Station near Zaria, 18.v.1959 (*W. A. Sands*). Imagos and workers in BMNH.

This species has only been found in the surface layers of low, wide mounds at the base of trees in Guinean savanna, probably built by *Odontotermes* species. Alates were collected at light in May between 6.45 and 7.15 p.m. after an early shower at the start of the rainy season.

ALYSCOTERMES gen. n.

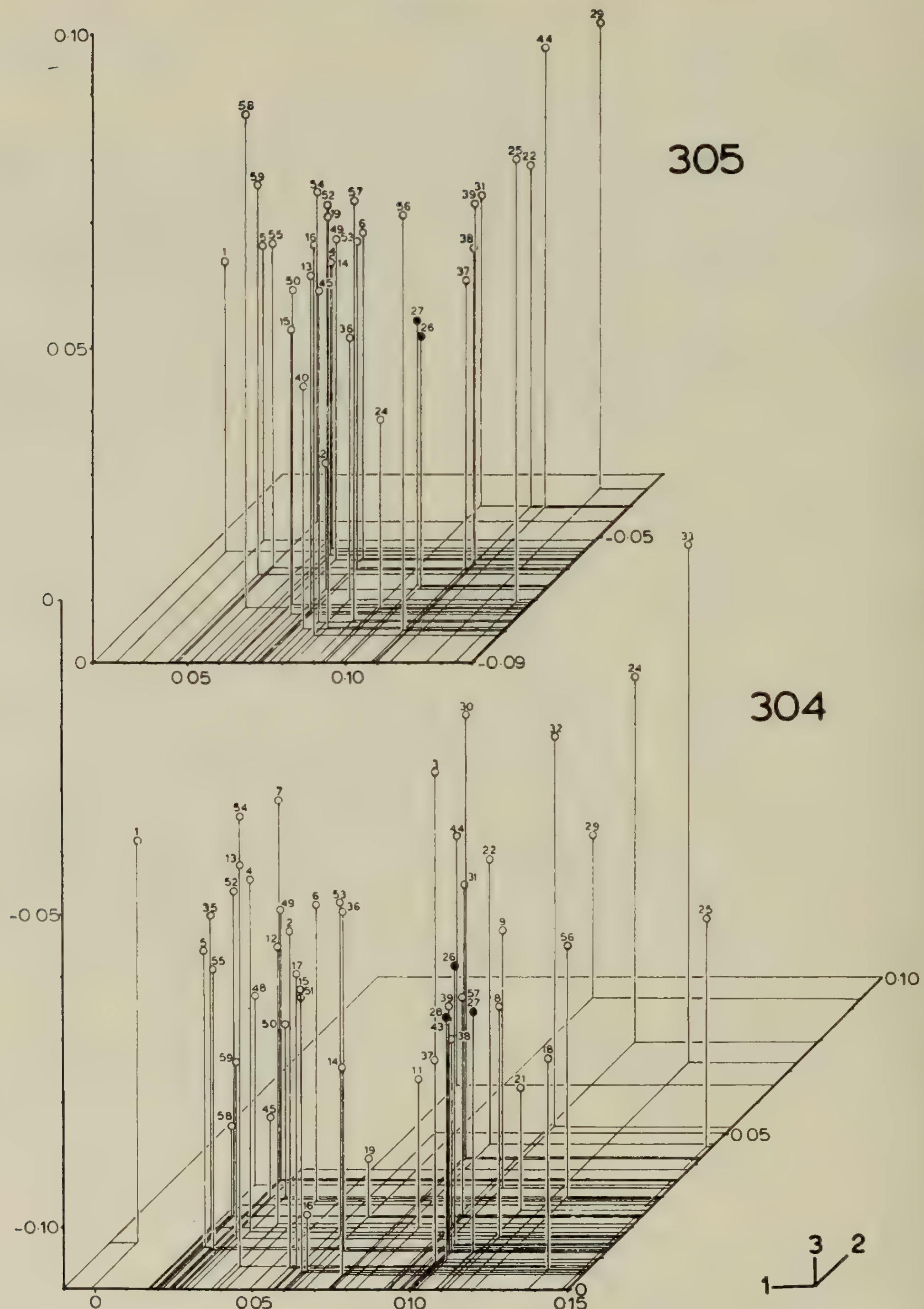
(Alysko, Gr., 'flee from, shun, wander')

Type-species: *Alyscotermes kilimandjaricus* (Sjöstedt)

Imago. Medium sized to large, W, 0·90–1·35. Fore tibia with three apical spurs, third only slightly smaller than other two. Apical teeth of mandibles fairly short, L_A/L_1, 0·49–0·66, R_A/R_1, 0·67–0·99; subsidiary marginal tooth of left mandible distinctly separated from molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 4·87–10·50. Right mandible with points of apical and marginal teeth more or less in line, anterior edge of first marginal distinctly longer than that of second. Meso- and metanota vary from moderately to distinctly wide at constriction, M/W, 0·28–0·37, transverse dark sutures present, usually distinct; complex ratio of mandible and notal measurements L_1/M.N, 0·84–1·85.

Worker. Medium sized to very large, W, 0·81–1·11. Fore tibia slender, T_1/T_w, 5·28–7·36, with three apical spurs, third usually well developed, sometimes reduced, never vestigial. Apical teeth of mandibles short, L_A/L_1, 0·50–0·67, R_A/R_1, 0·66–0·87; subsidiary marginal tooth of left mandible separated from molar prominence by deep notch in surface view, complex ratio, $L_A/L_1.L_m$, 6·42–12·75. Right mandible with apical and marginal teeth in line, anterior edges of marginal teeth subequal or first slightly longer, complex ratio, $R_A/R_1.R_m$, 10·13–15·40. Mesenteric junction with proctodeum diagonal, to right of malpighian knot. Enteric valve seating distinctly two-lobed, sometimes with very weakly developed third, connected to second pouch of proctodeum by definite neck, dorsolateral in unopened abdomen. Internal cushions of enteric valve unequally developed, positions 1 and 2 retracted, 3 and 4 slightly longer, produced through valve opening; all cushions armed with spines, minute in mesal third, small to pronounced in distal third, protruding through valve opening, particularly in positions 3 and 4.

The characteristic enteric valve armature of the worker caste makes this genus an easy one to recognize. A very few specimens of *A. kilimandjaricus* have been found in which it was less well developed and could only be seen after mounting and clearing, but in general the character can be seen at magnifications of around 100 × unmounted, in alcohol. Only in *Amalotermes* is the enteric valve somewhat similarly armed, but in this the small, brown-headed workers are distinctive, and the armature of the valve is approximately radially symmetrical. All the other genera with armed valves have their distinctive patterns which are illustrated. In the imago identification is more difficult. Of the genera with overlapping size-range and three apical spurs on the fore tibia, *Adynatotermes* has differently proportioned mandibles, as also do *Acholotermes*, *Aganotermes*, *Asagarotermes* and *Amicotermes*. The confusion arises with some members of *Astratotermes* and *Astalotermes* of Groups II and III. No satisfactory key character has been found to separate these from *Alyscotermes*. However, the individual species can be separately distinguished. In *Astratotermes*, *A. aneristus*, *A. apocnetus*, *A. hilarus* and *A. mansuetus* have the anterior edge of the right second marginal at least as long as the first. *A. pacatus* has large eyes and ocelli and *A. prosenus* longer apical teeth and conspicuous fontanelle. In *Astalotermes*, the most difficult species is *A. hapalus*, which very closely resembles *Alyscotermes* in the imago. The only differences are small ones in the proportions of the mandibles when compared with specimens from nearby localities, and the slightly more narrowly rounded head capsule and postclypeus. *A. aganus* and *A. mitis* both have a distinctly depressed pale fontanelle, and again, slightly different mandibles. *A. ignavus* and *A. murcus* both have very long head



FIGS 304 & 305. Three-dimensional graphs of canonical variates 1, 2 & 3, showing species of *Alyscotermes* as solid spots. 304, imago; 305, worker caste.

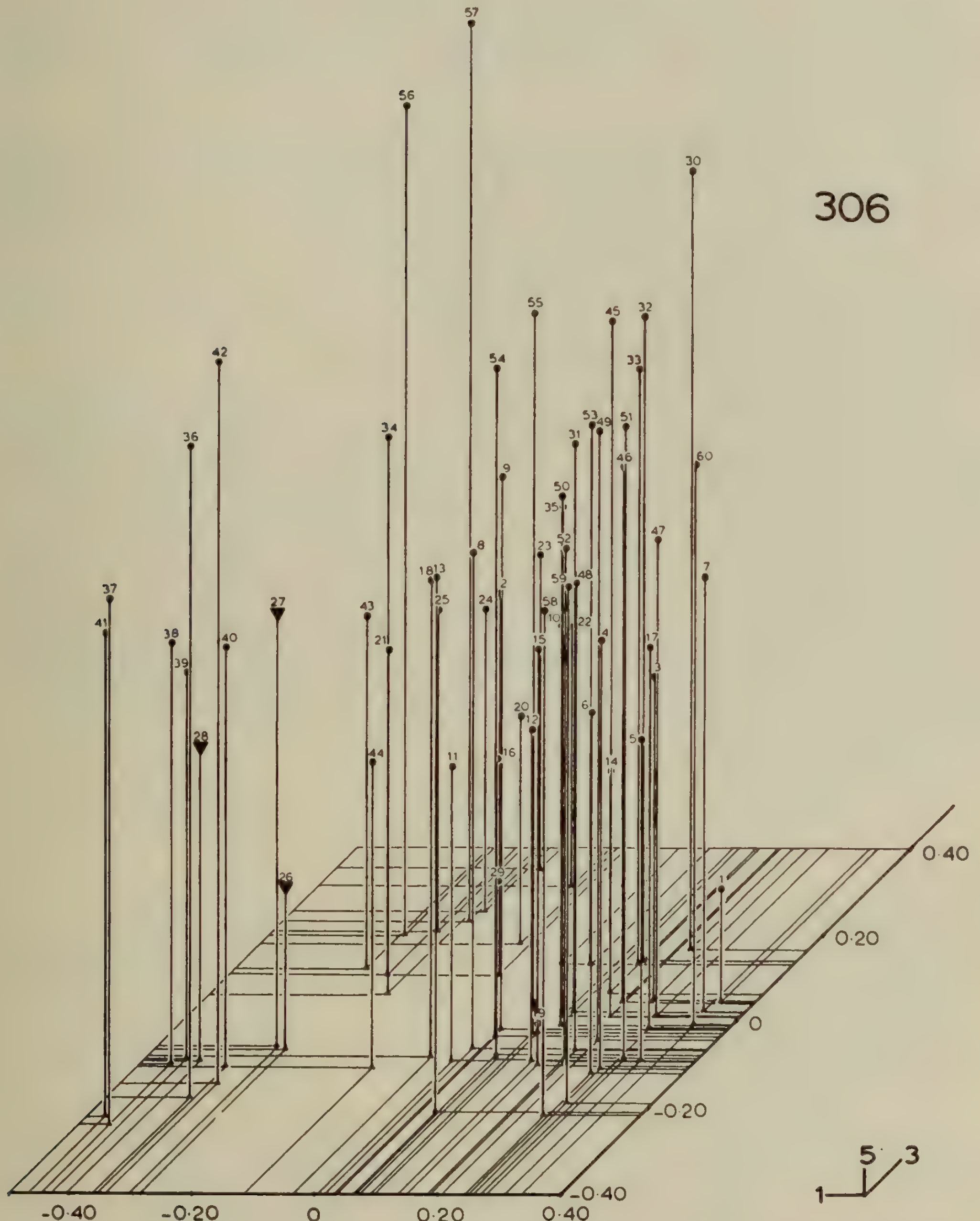


FIG. 306. Three-dimensional graph of principal co-ordinates analysis-plot of eigenvectors 1, 3 & 5 showing species of *Alyscotermes* marked by large triangles. *A. kilimandjaricus* is represented by two points as in cluster analysis.

setae. In *A. brevior* and *A. quietus*, the right first marginal is reduced, and shorter than the second. In *A. empodius* it is the subsidiary marginal tooth of the left mandible which is scarcely clear of the molar prominence; the fontanelle is pale and depressed. *A. irrixosus* is again very similar to *Alyscotermes* and was at first placed in that genus. The absence of enteric valve armature is in this case the only distinguishing feature.

Clearly *Astalotermes* and *Alyscotermes* are closely related, and, as indicated in the discussion on *Astalotermes*, other ways of delimiting genera to take account of this have been considered. The results of the principal co-ordinate analysis separate them, as do the cluster analyses. In order to be consistent with the results for some better defined genera, they are named as separate taxa. In the numerical analyses, *Alyscotermes* is placed nearest to *Ateuchotermes*. (Text-figs 304, 305 & 306 to be compared with Text-figs 400, 401 & 402.) The latter genus has a distinctive enteric valve and no confusion can arise between them.

The name of this genus refers to the frequency with which it has displayed the behaviour described by Grassé & Noirot (1951) as 'La sociotomie'. Entire colonies have been found migrating complete with physogastric queen over the soil-surface. This usually results from an attack by burrowing Doryline ants. The termites flee from their beleaguered nest tunnels and wander about looking for a new home.

No key is provided since the genus contains only two species, and presents no problem of identification once the generic identity of a specimen is recognized. *A. kilimandjaricus* (Sjöstedt) is widespread and common, *A. trestus* sp. n. is only known from one nest-series. It is distinguished from its commoner congener by the much more spiny enteric valve armature and slightly differently proportioned mandibles of the worker caste. The only difference in the imago of *A. trestus* is the more evenly rounded postclypeus.

Alyscotermes kilimandjaricus (Sjöstedt) **comb. n.**

(Text-figs 307–310 & 315–320; Pl. 2, figs 8–11)

Eutermes kilimandjaricus Sjöstedt, 1907 : 9. LECTOTYPE ♀, TANZANIA: Kilimandjaro, Kibonoto (Naturhistoriska Riksmuseum, Stockholm), here designated [examined].

Mirotermes (*Cubitermes*) *natalensis* Holmgren, 1913 : 355. Type-series, REPUBLIC OF SOUTH AFRICA: Natal, Amanzimtoti (1 ♀ syntype [examined] in American Museum of Natural History; rest of type-series in Mus. Götenborg). **Syn. n.**

Mirotermes (? *Procubitermes*) *mfolozii* Fuller, 1925 : 190. LECTOTYPE ♂, REPUBLIC OF SOUTH AFRICA: Zululand, White Mfolosi River, Conjeni (National Collection of Isoptera, Pretoria), here designated [examined]. **Syn. n.**

Imago. Head capsule sepia to very dark sepia or chestnut-brown; sometimes darker above ocelli; fontanelle broad to somewhat elongate oval, flat, ridged in middle or slightly raised smaller to distinctly larger than ocellus, orange-yellow to dark sepia-brown; medial spot flat or slightly raised, oval, smaller than fontanelle, coloured as head or a little paler; postclypeus yellow-brown to sepia-brown, labrum yellow to brown; frontal marks flat or slightly depressed crescents, distinctly paler than head; antennae yellow-brown to sepia-brown. Pronotum brown to dark sepia, meso- and metanota brown, transverse dark sutures variable, weak to distinct; femora pale yellow-brown to brown, tibiae paler, tarsi yellow. Abdominal tergites

brown to dark sepia-brown, dorsal stigmata paler or as tergites, sternites and ventral stigmata brown, sternites paler in middle, cerci yellow to pale brown.

Posterior margin of head capsule evenly rounded, or not quite so, slightly undulating; ocelli medium-sized, separated from compound eyes by from less than half to slightly more than own least diameter; postclypeus weakly to strongly inflated, Pcl/W, 0·20–0·34, posterior margin rarely evenly rounded, usually bowed in middle, median suture distinct. Pilosity of head capsule yellow-brown to brown, variable from fine, sparse, short slightly uneven pelt with emergent setae, to uneven, no pelt. Other characters as in generic diagnosis.

Measurements. ('*A. kilimandjaricus*' represented by 24 specimens from 16 localities, '*A. natalensis*' by 25 specimens from 12 localities—see discussion following descriptions) in millimetres.

'*A. kilimandjaricus*'

	Range	Mean ± S.D.
Head width across eyes (W)	0·90–1·35	1·146 ± 0·117
Ocellus ($O_w \times O_l$)	0·07–0·13 × 0·10–0·17	0·094 ± 0·014 × 0·125 ± 0·018
Ocellus to eye (O–E)	0·04–0·10	0·063 ± 0·015
Postclypeus length (Pcl)	0·22–0·34	0·289 ± 0·029
Antennal article III	0·02–0·08	0·045 ± 0·013
Antennal article IV	0·04–0·09	0·064 ± 0·016
Antennal article V	0·04–0·09	0·064 ± 0·015
Left mandible, apical to first marginal (L_A)	0·08–0·11	0·097 ± 0·007
Left mandible, first to third marginal (L_l)	0·14–0·20	0·172 ± 0·016
Left mandible, third marginal to molar (L_m)	0·06–0·10	0·085 ± 0·013
Right mandible, apical to first marginal (R_A)	0·09–0·11	0·100 ± 0·006
Right mandible, first to second marginal (R_l)	0·10–0·15	0·128 ± 0·014
Right mandible, second marginal to molar (R_m)	0·06–0·11	0·083 ± 0·013
Mesonotum width (M)	0·28–0·49	0·370 ± 0·056
Metanotum width (N)	0·29–0·50	0·374 ± 0·056

'*A. natalensis*'

	Range	Mean ± S.D.
Head width across eyes (W)	1·06–1·30	1·177 ± 0·064
Ocellus ($O_w \times O_l$)	0·07–0·10 × 0·09–0·13	0·084 ± 0·009 × 0·109 ± 0·013
Ocellus to eye (O–E)	0·05–0·10	0·068 ± 0·013
Postclypeus length (Pcl)	0·25–0·44	0·295 ± 0·039
Antennal article III	0·03–0·06	0·044 ± 0·008
Antennal article IV	0·05–0·08	0·062 ± 0·009
Antennal article V	0·05–0·08	0·061 ± 0·007
Left mandible, apical to first marginal (L_A)	0·09–0·12	0·101 ± 0·006
Left mandible, first to third marginal (L_l)	0·16–0·20	0·176 ± 0·010
Left mandible, third marginal to molar (L_m)	0·07–0·10	0·083 ± 0·007
Right mandible, apical to first marginal (R_A)	0·09–0·11	0·100 ± 0·006

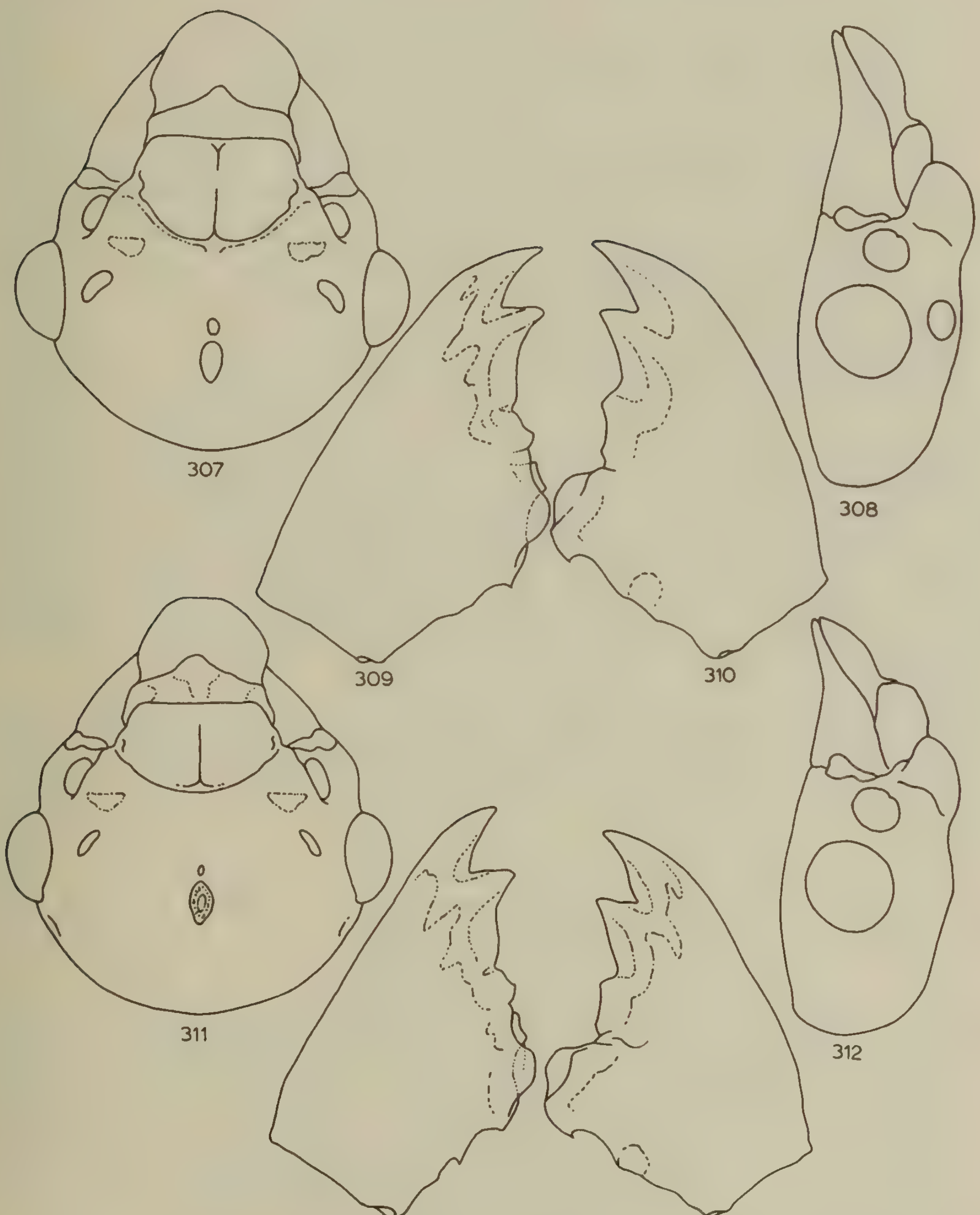
Right mandible, first to second marginal (R_l)	0·11–0·15	0·129 ± 0·009
Right mandible, second marginal to molar (R_m)	0·08–0·10	0·082 ± 0·006
Mesonotum width (M)	0·30–0·44	0·365 ± 0·036
Metanotum width (N)	0·30–0·43	0·369 ± 0·037

Worker. Head capsule yellow-white to yellow, pilosity yellow, sparse. Postclypeus weakly to moderately inflated, Pcl/W, 0·21–0·29, Pcl/R_l, 1·89–2·71. Left mandible with subsidiary marginal tooth about same size as third marginal, separated from molar prominence by wide deep notch in surface view, complex ratio, $L_A/L_1.L_m$, 7·90–12·75, anterior edges of first and second marginal teeth of right mandible equal, $R_A/R_1.R_m$, 10·49–15·40. Enteric valve armature in cushion position 3 with 1–9 (only two recorded with more than five) pronounced spines, position 4 sometimes not produced through valve opening, rarely with more than one pronounced spine of ten only small spines, both positions with further small or minute spines; positions 1 and 2 with a few small spines, or all spines minute. Membranous wall of valve beyond cushions with minute spicules. Other characters as in generic diagnosis.

Measurements (in millimetres).

	'*A. kilimandjaricus*'		'*A. natalensis*'	
	Range	Mean ± S.D.	Range	Mean ± S.D.
Head width (W)	0·81–1·05	0·934 ± 0·069	0·84–1·00	0·925 ± 0·051
Fore tibia width (T_w)	0·09–0·14	0·114 ± 0·010	0·11–0·13	0·115 ± 0·007
Fore tibia length (T_l)	0·56–0·84	0·689 ± 0·090	0·63–0·71	0·678 ± 0·030
Postclypeus length (Pcl)	0·19–0·33	0·268 ± 0·032	0·21–0·26	0·235 ± 0·017
Left mandible, apical to first marginal (L_A)	0·08–0·10	0·088 ± 0·005	0·08–0·09	0·087 ± 0·006
Left mandible, first to third marginal (L_l)	0·13–0·16	0·148 ± 0·010	0·13–0·15	0·143 ± 0·007
Left mandible, third marginal to molar (L_m)	0·05–0·07	0·060 ± 0·007	0·05–0·06	0·058 ± 0·005
Right mandible, apical to first marginal (R_A)	0·08–0·09	0·087 ± 0·005	0·07–0·09	0·083 ± 0·006
Right mandible, first to second marginal (R_l)	0·09–0·12	0·109 ± 0·008	0·09–0·11	0·103 ± 0·006
Right mandible, second marginal to molar (R_m)	0·05–0·07	0·060 ± 0·005	0·05–0·06	0·060 × 0·004

The essential differences between *A. kilimandjaricus* and *A. trestus* have been mentioned under the generic heading in lieu of a key. The two are clearly very closely related, and *A. trestus* appears to be a local species that has arisen in the anomalous and ecologically isolated area of the Mara forest. *A. kilimandjaricus* has the widest distribution of any of the species in this monograph. It is found from the Gambia in West Africa to Cape Province in South Africa, and in consequence has one of the longest ranges of any African termite. Until a late stage in the present work it was regarded as two species, *A. kilimandjaricus* for the northern specimens and *A. natalensis* for the southern. Slight differences in shape, pilosity and in the gut-characters were thought to occur between them, and were coded accordingly for their separate inclusion in the similarity analysis. However, re-assessment of these features took place when it became necessary to key out the two species. No clear distinction could be made between them on any character or combination of characters and there are not sufficient differences even to warrant



FIGS 307–314. *Alyscotermes*, imago head capsules, front and side views, and imago mandibles. 307–310, *A. kilimandjaricus*; 311–314, *A. trestus*.

the retention of subspecific divisions. The specimens from West Africa and Uganda have a tendency to slightly more even pilosity, forming a pelt on the imaginal head-capsule, which is also slightly less evenly rounded. In the worker, the northern forms sometimes have traces of a third lobe to the enteric valve seating, a marginally longer mesenteric overlap with the proctodeum, and somewhat weaker enteric valve-armature. There are some indications that these character differences may form a cline. In order to show the close similarity of size and proportions throughout the range, the two groups of measurements are given separately rather than amalgamated. The abdomen of the worker caste is dehiscent in *A. kilimandjaricus*.

A lectotype has been designated below from the existing syntype material of *A. kilimandjaricus* (Sjöstedt), and from the syntypes of its junior synonym *Mirotermes* (*Procubitermes*) *mfolozii* Fuller.

Type-material. *Eutermes kilimandjaricus* Sjöstedt, LECTOTYPE ♀ imago, paralectotype ♂ and ♀ imagos from type-series, TANZANIA: Kilimanjaro, Kibonoto, 17.viii.1905 (*Y. Sjöstedt*), in Naturhistoriska Riksmuseum, Stockholm; paralectotype ♀ in American Museum of Natural History. *Mirotermes* (*Cubitermes*) *natalensis* Holmgren, type-series, REPUBLIC OF SOUTH AFRICA: Natal, Amanzimtoti (*I. Trägårdh*), one ♀ in American Museum of Natural History, rest of type-series in Mus. Göteborg. *Mirotermes* (*? Procubitermes*) *mfolozii* Fuller, LECTOTYPE ♂ imago and paralectotype ♂ imagos from type-colony, REPUBLIC OF SOUTH AFRICA: Zululand, White Mfolozi River, Conjeni, S. bank, 27.iii.1922 (*R. H. Harris*) (Fuller Coll. No. F1288), in N.C.I., Pretoria; other paralectotypes (Fuller Coll. No. F1530), in National Collection of Isoptera, Pretoria and American Museum of Natural History.

Other material. GAMBIA: 35 m. from Bathurst on Brikama Road, 18.ix.1966 (*W. A. Sands*). GUINEA: Mount Nimba, 6.ix.1946 (*M. Lamotte*), AMNH. IVORY COAST: Mount Nimba, Yale, 14.iv.1968 (*G. Josens*). NIGERIA: Northern Region, Adamawa Prov., Tibak Plateau, Donkin (two vials), 24.v.1957 (*W. A. Sands*). DEMOCRATIC REPUBLIC OF CONGO: Albert National Park, Rwindi Camp, 4.v.1948 (*A. E. Emerson*) AMNH; Garamba National Park, 15.iii.1951 (*H. De Saeger*). UGANDA: Kawanda, iv.1949 (*W. V. Harris*); Karamoja District, Moroto, 7.x.1952 (*W. A. Sands*); Kawanda, 17.ii.1968 (*D. J. Greathead*). KENYA: Nairobi, Muthaiga Forest, 21.ix.1950, Muguga, 21.v.1950 (two vials), Meru, Lower Imenti Forest, 15.ii.1952, Muguga, 7.v.1952 (*W. V. Harris*), Muguga, 7.v.1952, Isiolo, 4.i.1953 (*W. A. Sands*); Kwale, Shimba Hills, 15.vi.1952 (*P. B. Kemp*); Kaptagat, 11.v.1954, Muguga, 8.xi.1954 (*R. M. C. Williams*). TANZANIA: Morogoro, 27.iv.1935, 3.iii and 8.v.1927 (*W. V. Harris*); Babati, Bereku Ridge, 20.iii.1951, Shume, W. Usambara, 20.x.1951, Mombo, Soni, 11.x.1951, Mgera, 25.ii.1952. Daluni, near Amani, 1.iv.1952 (*P. B. Kemp*). MALAWI: Chisenga, S. of Fort Hall, 5.viii 8 m. E. of Cholo on Mlanje Road, 18.viii, Vipya Plateau, 20.ix, 27 m. from Nkata Bay on Ekwendeni Road, 2.ix and 1 m. N. of Chisenga, 2.x.1953 (*W. A. Sands & W. Wilkinson*); Mlanje Mountain, vii–ix and Zomba Mountain, ix.1956 (*A. W. R. McCrae*). RHODESIA: Matopos (three vials), 23–24.i and 8.iii.1966 (*M. G. Bingham*); Salisbury, 10.i.1967 (*R. N. H. Smithers*). REPUBLIC OF SOUTH AFRICA: Transvaal, Pretoria,

21.x.1916 and 9.v.1917 (*C. Fuller*); 26 m. S. of Johannesburg, 9.iv.1935 (*H. Kirby*), AMNH; Pretoria, 6.v.1938, Sibasa, 9.vii.1960 (*W. G. H. Coaton*); Belfast, 27.iv, Ermelo (three vials), 3–6.vi.1956 (*J. H. Grobler*); Rustenburg (two vials), 26.i and Middelburg, 22.iv.1960 (*P. C. Joubert*); Bronkhorstspruit, 11.iii.1962 (*J. L. Sheasby*), N.C.I., Pretoria. Natal, Haviland Rail (two vials), Estcourt, 1894 (*G. D. Haviland*); Charlestown (*I. Trägårdh*); Hilton Road, 1913 (*E. Warren*); Tongaat, 19.iv.1914 (*C. Fuller*), all AMNH; Nkandhla (three vials), 27–28.i.1957, Mahlabatini, 6.xii, Umzimkulu, 17.xii, Lions River, 19.xii and Bergville, 21.xii.1959 (*P. C. Joubert*); Impendhle, 21.i.1962 (*J. L. Sheasby*); Orange Free State, Heilbron, 22.v.1938 (*W. G. H. Coaton*) all N.C.I., Pretoria; Cape Province, Kentani, iv.1918 (*A. Pegler*); Zwartkop, 7 m. from Port Elizabeth, 20.iii.1914 (*Anon.*), N.C.I. and AMNH; Port St. Johns, 14.iii.1938, Albany, 26.i.1958, Somerset East, 7.ii.1961 (*W. G. H. Coaton*), Albany (five vials), 12.viii.1951, 20.vi and 1.xi.1955, 9.vi.1957 and 29.vii.1961 (*E. McCallan, J. Myers, F. W. Gess*); Umzimkulu, 20.i, Qumbu, 10.x and Flagstaff, 12.x.1962 (*J. L. Sheasby*); Tsolo, 15.x and Komgha, 22.x.1962 (*G. F. Pretorius*), all in N.C.I., Pretoria.

Specimens listed above are in the BMNH unless otherwise stated. Eighty-four nest-series have been examined and something is known of the biology. The species does not construct a mound, but has been found in the mounds of *Cubitermes*, under rocks, and swarming from subterranean tunnels. Many of the records are from high altitudes, up to 8000 feet above sea level. In general it appears commonest in fairly moist savanna, often adjacent to rain forest, though a few records are from drier areas. This species appears to be more ready than most termites to leave its underground nest system to wander on the surface. On a number of occasions (at least five) it has been recorded on the march complete with reproductive castes; this behaviour usually results from attacks by burrowing Doryline ants, and in one instance the species of ant has been identified as *Rhogmus fimbriatus* (Shuckard).

Alyscotermes trestus sp. n.

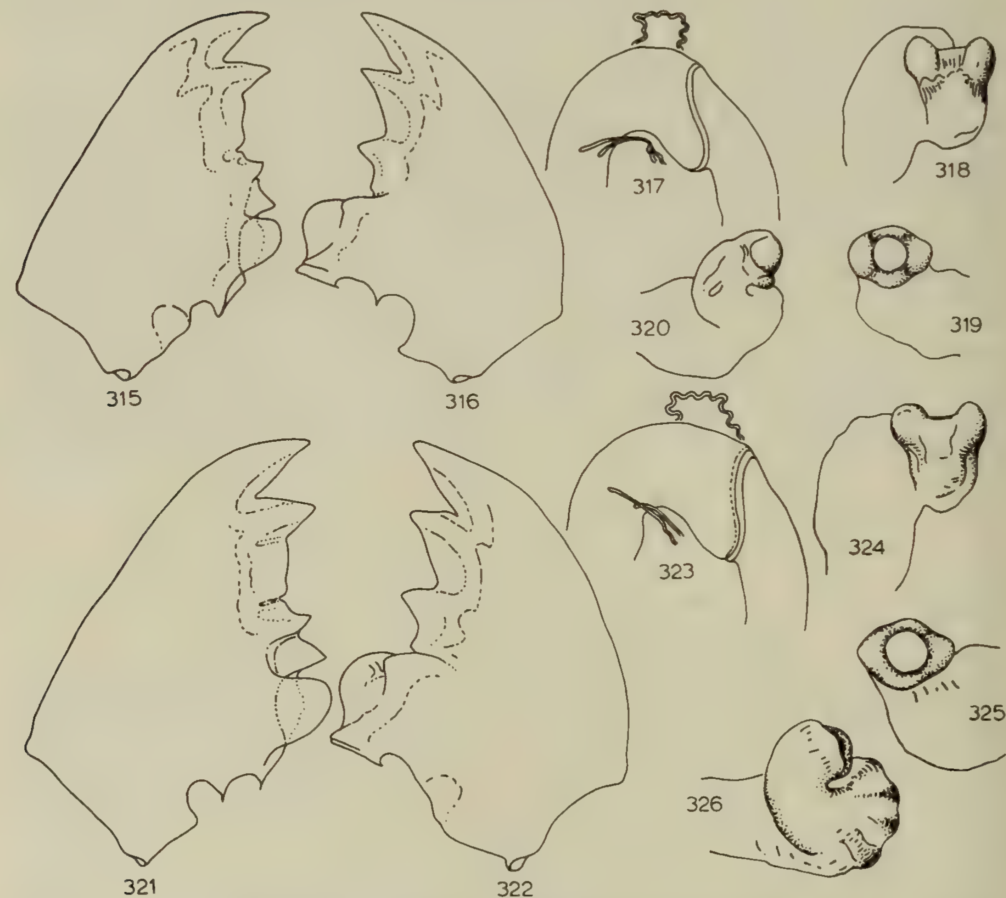
(Text-figs 311–314 & 321–326; Pl. 2, figs 6 & 7)

Imago. Head capsule dark chestnut-brown, very dark above ocelli; fontanelle oval, flat, slightly raised, or depressed in middle, somewhat roughened, a little smaller than ocellus-chestnut-brown; medial spot circular or short oval, slightly distinct, slightly depressed chestnut, brown, semicircular; antennae sepia-brown. Pronotum, meso- and metanota chestnut-brown. Transverse dark sutures distinct; femora sepia-brown, tibiae paler, tarsi yellow-brown. Abdominal tergites and dorsal stigmata, chestnut-brown, sternites and ventral stigmata brown, sternites yellow-brown in middle; cerci pale yellow-brown.

Posterior margin of head capsule not quite evenly rounded, slightly undulating; ocelli small, separated from compound eyes by own least diameter or slightly more; postclypeus weakly inflated, Pcl/W, 0·22–0·25, posterior margin broadly and evenly rounded, median suture distinct. Pilosity of head capsule brown, coarse pelt obscured by numerous uneven emergent setae. Other characters as in generic diagnosis.

Measurements (two specimens from one colony) in millimetres.

Head width across eyes (W)	1·22–1·29
Ocellus ($O_w \times O_l$)	0·09–0·10 × 0·11
Ocellus to eye (O–E)	0·09–0·12
Postclypeus length (Pcl)	0·29–0·30
Antennal article III	0·04–0·05
Antennal article IV	0·05–0·06
Antennal article V	0·06
Left mandible, apical to first marginal (L_A)	0·10–0·11
Left mandible, first to third marginal (L_1)	0·18
Left mandible, third marginal to molar (L_m)	0·09
Right mandible, apical to first marginal (R_A)	0·10–0·11



FIGS 315–326. *Alyscotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seatings. 315–320, *A. kilimandjaricus*; 321–326, *A. trestus*.

Right mandible, apical to second marginal (R_l)	0·13
Right mandible, second marginal to molar (R_m)	0·09–0·10
Mesonotum width (M)	0·40–0·46
Metanotum width (N)	0·39–0·46

Worker. Head capsule yellow, pilosity sparse and scattered, orange. Postclypeus moderately inflated, Pcl/W, 0·27, Pcl/R_l, 2·37. Left mandible with subsidiary marginal tooth larger and more prominent than third marginal, separated from molar prominence by wide deep notch in surface view, complex ratio, $L_A/L_l.L_m$, 6·42; first marginal tooth of right mandible with anterior edge slightly longer than that of second, $R_A/R_l.R_m$, 10·13. Enteric valve armature of positions 3 and 4 with 7–12 pronounced spines, carried on slightly sclerotized cushions, and many small and minute spines; positions 1 and 2 with 1–3 pronounced spines, cushions unsclerotized, many small and minute spines. Membranous wall of valve beyond cushions with minute spicules. Other characters as in generic diagnosis.

Measurements (one specimen) in millimetres.

Head width (W)	1·11
Fore tibia width (T_w)	0·13
Fore tibia length (T_l)	0·78
Postclypeus length (Pcl)	0·30
Left mandible, apical to first marginal (L_A)	0·10
Left mandible, first to third marginal (L_l)	0·17
Left mandible, third marginal to molar (L_m)	0·09
Right mandible, apical to first marginal (R_A)	0·11
Right mandible, first to second marginal (R_l)	0·13
Right mandible, second marginal to molar (R_m)	0·08

The distinguishing features of *A. trestus* have already been discussed in comparison with *A. kilimandjaricus*. The asymmetrical development of the enteric valve armature in the worker may represent an early stage in the development of a valve like that of *Anaorotermes*. The abdomen of the worker caste shows signs of being dehiscent in some specimens.

Holotype ♀ imago, paratype ♂ and ♀ imagos, and workers from type-colony, KENYA: Narok District, Mara, 9 miles from Olokurto, 16.v.1961 (*P. E. Glover*) coll. No. G7553) in British Museum (Natural History).

There is no biological information on the single known nest-series.

AGANOTERMES gen. n.

(Aganos, Gr., 'mild, gentle')

Type-species: *Aganotermes oryctes* sp. n.

Imago. Large-sized, W, 1·11–1·23. Fore tibia with three apical spurs, third well developed, a little shorter than other two. Apical teeth of mandibles long, L_A/L_l, 0·79–0·83, R_A/R_l, 1·11–1·19; subsidiary marginal tooth of left mandible with proximal end just level with edge

of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 10·41–12·04. Points of apical and marginal teeth of right mandible in line, anterior edge of first marginal longer than that of second. Meso- and metanota narrow at constriction, M/W, 0·21–0·24, transverse dark sutures absent.

Worker. Large, W, 0·86–0·94. Fore tibia scarcely swollen, T_l/T_w, 5·00–5·53, with three apical spurs, third about one-third length of other two. Apical teeth of mandibles very long, L_A/L_1, 0·97–1·00, R_A/R_1, 1·25–1·29; subsidiary tooth of left mandible with proximal end level with edge of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 25·81–26·66; points of apical and marginal teeth of right mandible in line, anterior edge of first marginal longer than that of second, complex ratio, $R_A/R_1.R_m$, 25·40–30·25. Mesenteric overlap at junction with proctodeum twice width of mesenteron at insertion of malpighian tubules or a little more, proximal end of proctodeum within malpighian knot, towards left side. Enteric valve seating with two very weak lobes, connected to second pouch of proctodeum by very short neck, ventral in position in unopened abdomen; internal cushions of enteric valve without armature, surface scaly.

This is again a monotypic genus, slightly related to *Adynatotermes*, and perhaps to some species of *Astalotermes*, but readily recognizable by its long mandibular apical teeth. In this respect it resembles the next genus, *Acholotermes*, but the meso- and metanota of the imago are narrower, and the ocelli much more distant from the compound eyes. In the worker, the enteric valve seating has a much shorter neck, and is more ventral in the unopened abdomen. The only other genera with equally long apical teeth are *Asagarotermes* and *Amicotermes*. In the imagos these have the left subsidiary marginal tooth clear of the molar prominence, the ocellus closer to the eye, and a more inflated postclypeus. The workers of these genera each have uniquely characteristic enteric valve armature. In the results of the analysis of the similarity matrix, the principal co-ordinates place *Aganotermes* near the rather large, loose cloud of points that form the genus *Astalotermes*, and fairly close to *Adynatotermes*. The cluster analyses both bring it out very late, remaining independent in the single linkage down to the 78% phenon level, joining after *Astalotermes obstructus* and before another monotypic genus, *Amicotermes*. When clustered by median sorting, it remains unattached until the last five places, four of which form monotypic genera, at the 70% phenon line. In the canonical variates analysis based on measurements alone, *Aganotermes* is one of the most isolated genera.

Aganotermes oryctes sp. n.

(Text-figs 327–336; Pl. 2, fig. 12)

Imago. Head capsule sepia-brown to very dark sepia-brown, definitely darker above ocelli, dark often extending as tapering streaks converging to fontanelle; fontanelle very small, oval, depressed, coloured as head capsule; medial spot as large as or larger than fontanelle, oval, paler than head capsule, raised on distinct bump; postclypeus, slightly paler than head capsnle, labrum, yellow-brown to brown, frontal marks semicircular, flat, paler than head; antennae yellow-brown to sepia-brown. Pronotum, brown to dark sepia-brown, meso- and metanota brown; femora pale yellow-brown to brown, tibiae paler, tarsi yellow. Abdominal tergites brown to sepia-brown, dorsal stigmata darker, sternites brown, paler in mid-line, stigmata darker; cerci very pale brown.

Posterior margin of head capsule not quite evenly rounded, slightly undulating; ocelli rather small, separated from compound eyes by much more than own least diameter; postclypeus

moderately inflated, Pcl/W, 0·24–0·28, posterior margin bowed, not evenly rounded, median suture distinct; pilosity of head capsule dense, uneven, rather coarse, not forming a pelt. Other characters given in generic diagnosis.

Measurements (six specimens from three localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	1·11–1·23	1·150 ± 0·031
Ocellus ($O_w \times O_l$)	0·08–0·09 × 0·09–0·13	0·080 ± 0·015 × 0·102 ± 0·015
Ocellus to eye (O–E)	0·09–0·13	0·112 ± 0·010
Postclypeus length (Pcl)	0·28–0·31	0·296 ± 0·013
Antennal article III	0·06–0·08	0·067 ± 0·005
Antennal article IV	0·07–0·09	0·077 ± 0·004
Antennal article V	0·07–0·08	0·077 ± 0·004
Left mandible, apical to first marginal (L_A)	0·14–0·16	0·153 ± 0·005
Left mandible, first to third marginal (L_l)	0·18–0·20	0·189 ± 0·007
Left mandible, third marginal to molar (L_m)	0·07–0·08	0·074 ± 0·004
Right mandible, apical to first marginal (R_A)	0·15–0·17	0·158 ± 0·007
Right mandible, first to second marginal (R_l)	0·13–0·15	0·138 ± 0·007
Right mandible, second marginal to molar (R_m)	0·07–0·09	0·077 ± 0·004
Mesonotum width (M)	0·24–0·28	0·257 ± 0·014
Metanotum width (N)	0·22–0·27	0·243 ± 0·018

Worker. Head capsule very pale yellow, pilosity dense, with long conspicuous coarse yellow setae. Postclypeus strongly inflated, Pcl/W, 0·35–0·36; Pcl/R_l, 3·25–3·50. Membranous wall of enteric valve beyond cushions apparently without even minute spicules. Other characters in generic diagnosis.

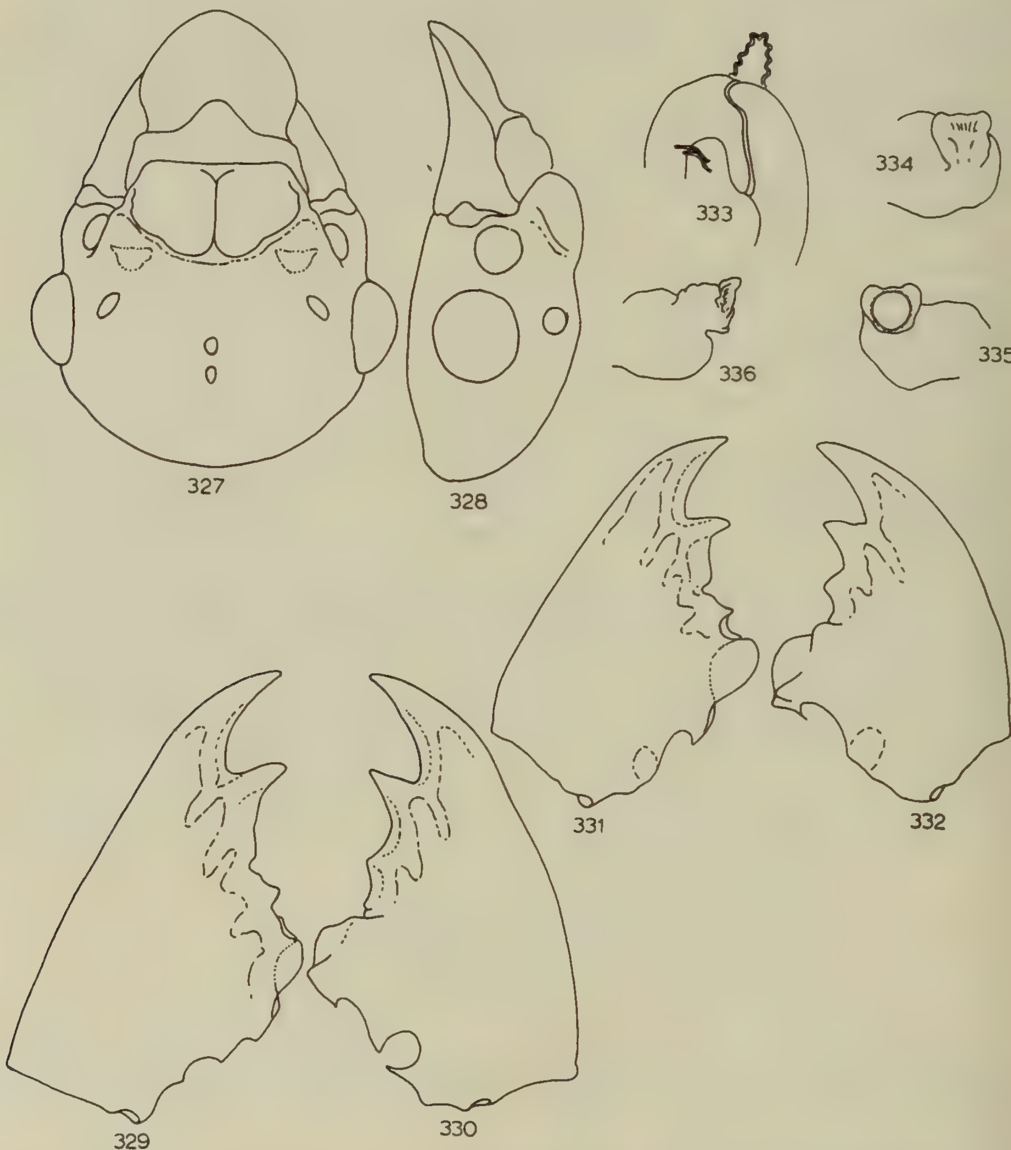
Measurements (two specimens from two localities) in millimetres.

Head width (W)	0·86–0·94
Fore tibia width (T_w)	0·11–0·13
Fore tibia length (T_l)	0·59–0·63
Postclypeus length (Pcl)	0·30–0·33
Left mandible, apical to first marginal (L_A)	0·13
Left mandible, first to third marginal (L_l)	0·13
Left mandible, third marginal to molar (L_m)	0·04
Right mandible, apical to first marginal (R_A)	0·11–0·13
Right mandible, first to second marginal (R_l)	0·09–0·10
Right mandible, second marginal to molar (R_m)	0·04–0·06

The relationships of this species, and its distinguishing features, have already been discussed under the generic heading. The abdomen of the worker caste appears to be dehiscent in *Aganotermes oryctes*.

Holotype ♀ imago, paratype ♂ and ♀ imagos, and workers from type-colony, REPUBLIC OF SOUTH AFRICA: Transvaal, Letaba, 10.ii.1964 (*W. G. H. Coaton*) in National Collection of Isoptera, Coll. No. TM.13,333, Pretoria; paratypes from type-colony also in BMNH.

Other paratype material, REPUBLIC OF SOUTH AFRICA: Transvaal, Warmbaths, 12.ii.1963 (*W. G. H. Coaton*). RHODESIA: Matopos: Research Station, 20°25′S., 28°30′E., alt. 4,000 ft, 16.xi.1965 and 23.i.1966, Atlantica Research Station, Salisbury district, 16°29′S., 30°14′E., alt. 3,700 ft, 7.xi.1965 (*M. G. Bingham*); Ruwa, Melfort,



FIGS 327–336. *Aganotermes oryctes*. 327, 328, front and side views of imago head capsule; 329, 330, imago mandibles; 331, 332, worker ditto; 333, mesenteric-proctodeal junction showing attachment of malpighian tubules and position of malpighian knot; 334–336, views of enteric valve seating.

17°57′S., 31°16′E., 12.xii.1969 (*B. L. Mitchell*). ZAMBIA: Lusaka, 9.xii.1966 and Chipongwe, 16.xi.1969 (*M. G. Bingham*).

Material in BMNH except where stated otherwise.

The only biological information on this species is that it is found as a 'lodger' in mounds of *Odontotermes* and *Macrotermes*.

ACHOLOTERMES gen. n.

(Acholos, Gr., 'meek')

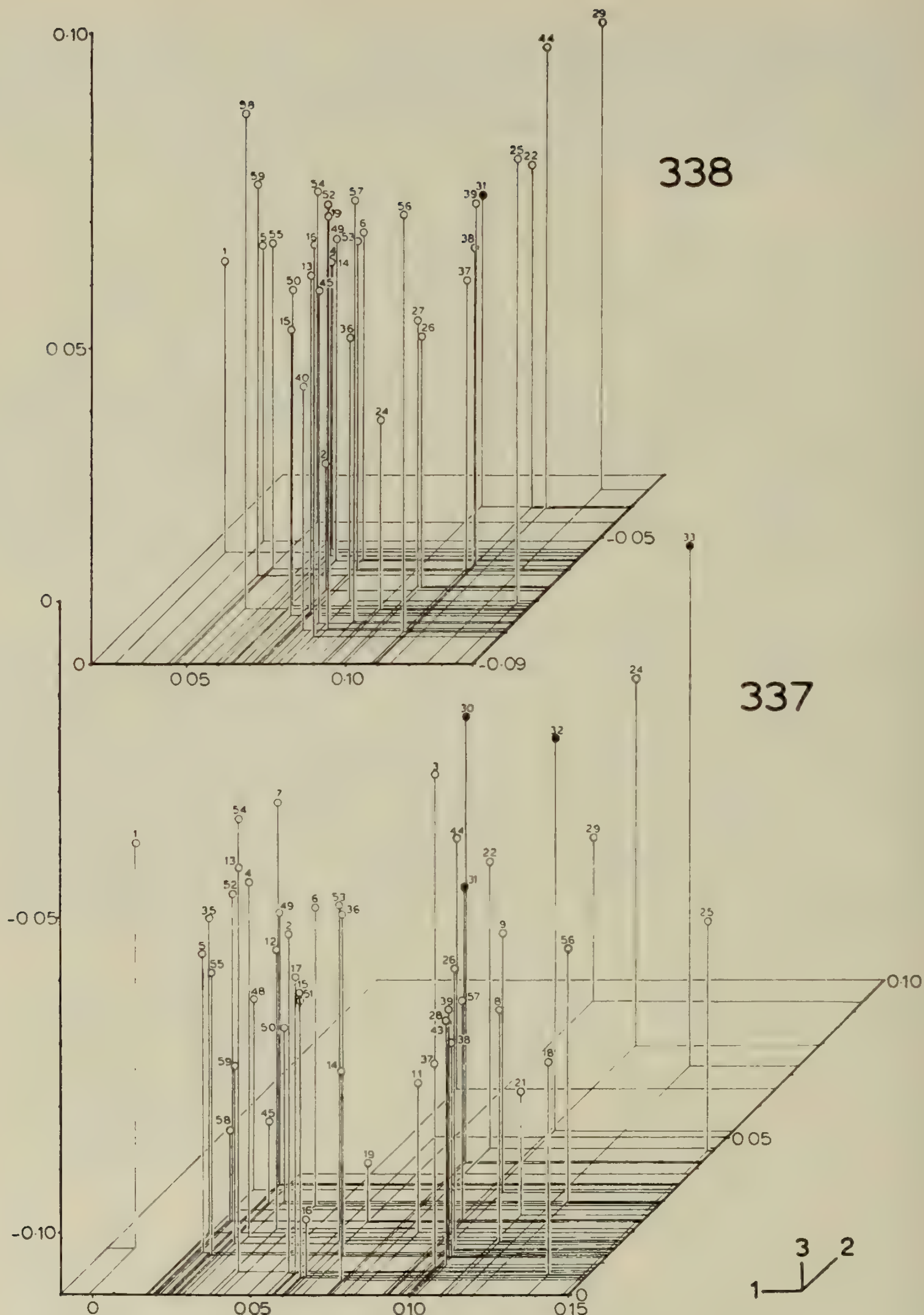
Type-species: *Acholotermes tithasus* sp. n.

Imago. Medium sized, W, 0·84–1·06. Fore tibia with three apical spurs, third small to well developed. Apical teeth of mandibles long, L_A/L_l, 0·68–1·04, R_A/R_l, 0·92–1·45; subsidiary marginal tooth of left mandible with proximal end level with edge of molar prominence or just clear of it in surface view, complex ratio, $L_A/L_l.L_m$, 11·59–16·29. Point of first marginal tooth of right mandible slightly to distinctly behind line of apical to second marginal, anterior edge of first marginal equal to or a little longer than that of second. Meso- and metanota rather narrow to somewhat wider at constriction, M/W, 0·25–0·32, transverse dark sutures weak or absent in type-species, present in others; complex ratio of mandible and notal measurements, L_l/M.N, 1·26–2·58.

Worker. Medium sized, W, 0·70–0·80. Fore tibia scarcely to moderately swollen, T_l/Tw, 3·91–5·30, with three apical spurs, third usually well developed, small to vestigial in one species. Apical teeth of mandibles long to very long. L_A/L_l, 0·81–1·07, R_A/R_l, 0·97–1·29, subsidiary marginal tooth of left mandible just clear of molar prominence in surface view or separated by distinct notch, complex ratio, $L_A/L_l.L_m$, 20·75–22·89; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal shorter than that of second or equal to it, complex ratio, $R_A/R_l.R_m$, 22·80–30·15. Mesenteric junction with proctodeum practically transverse and to right of malpighian knot in three or four species, overlapping by twice width of mesenteron and touching malpighian knot in the fourth. Enteric valve seating distinctly but not prominently three-lobed, connected to second pouch of proctodeum by long neck, lateral to dorso-lateral in position in unopened abdomen; internal cushions of enteric valve with scaly surface, posterior margin of each scale with one or more minute spines or spicules.

Three of the four species of *Acholotermes* form a compact, well defined group with many features in common. The fourth, *A. epius*, with a longer mixed segment and reduced third apical spur of the fore tibia shows resemblances to *Anenteotermes* and *Astalotermes* species. These are reflected in both the single linkage cluster analysis and the principal co-ordinate plots (Text-fig. 339). Median sorting leaves all four species together, with *A. epius* joining the group at a phenon level 10% lower than the linkage between the other species, at the same level of affinity as that of certain members of other genera.

The long apical mandibular teeth of both imago and worker castes serve to distinguish *Acholotermes* from most other genera. Those *Astalotermes* that overlap in this respect are smaller, with narrower meso- and metanota and in the worker have unarmed enteric valves. *Anenteotermes* has one species with similarly long apical teeth, but this too is smaller and has many other differences. Two species of *Astratotermes* that partially overlap in the mandible characters can in fact be



FIGS 337 & 338. Three-dimensional graphs of canonical variates 1, 2 & 3 showing species of *Acholotermes* as solid spots. 337, imago; 338, worker caste.

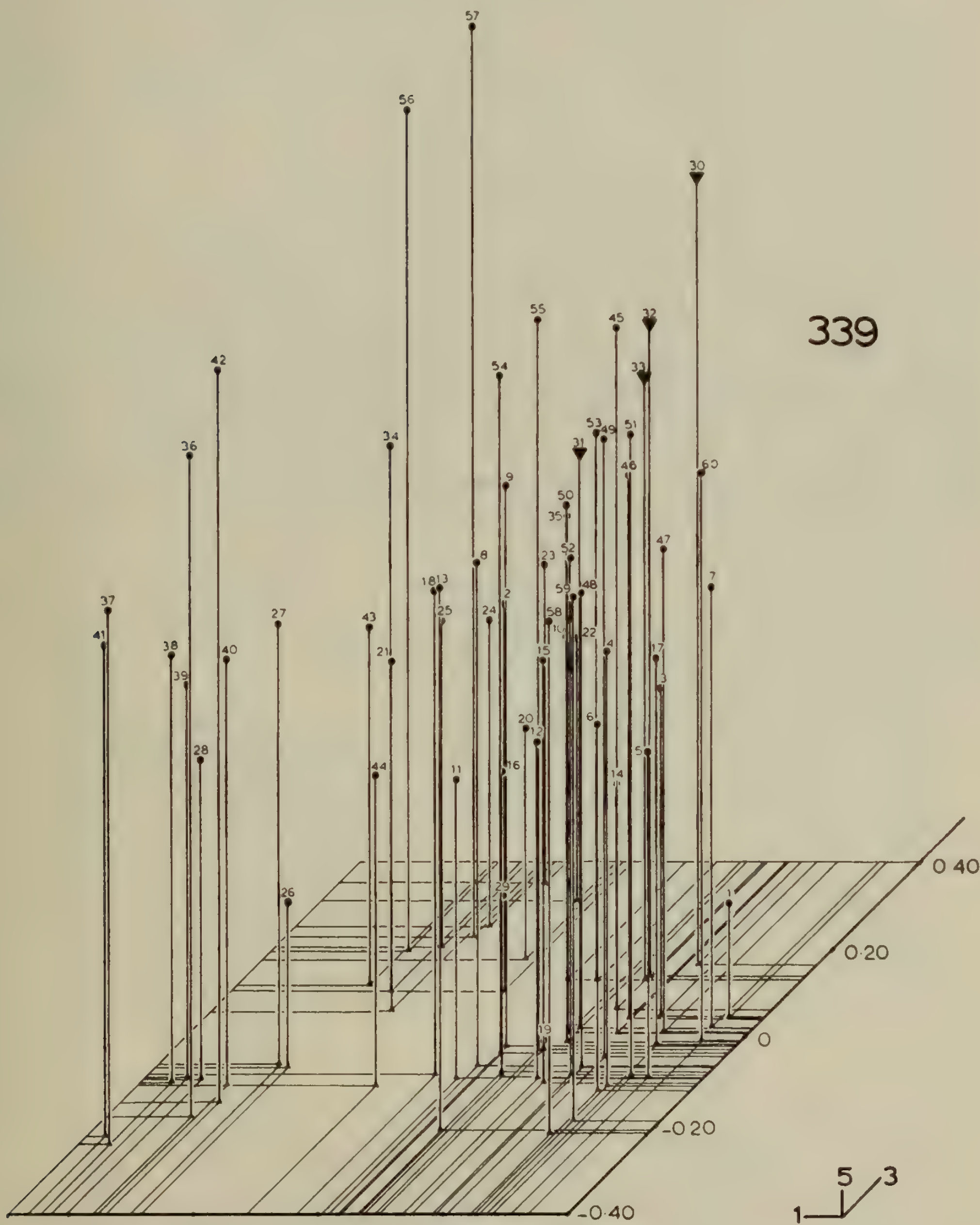


FIG. 339. Three-dimensional graph of principal co-ordinates analysis-plot of eigenvectors 1, 3 & 5 showing species of *Acholotermes* marked by large triangles.

separated in the imago by the complex ratios, or in one of them by the even pilosity and large size; in the worker the complex ratios again serve to separate the genera. The enteric valve cushions of *Astratotermes* have small spines on the posterior parts only, and few spicules or none on the membrane beyond them. In *Acholotermes* the entire enteric valve cushion carries minute spines or multiple spicules fringing the scales, and the membranous wall beyond and between them has a distinct or even thick fringe of spicules. To see those effectively requires phase-contrast illumination and so they are not used in diagnoses or keys. These and the small differences of proportion are enough in the multivariate analysis to separate the *Acholotermes* from the species of *Astratotermes* that resemble it as widely as some very distinctive genera are separated (Text-figs 337, 338 & 339, compare with Text-figs 304–306). In order to achieve consistency of treatment and maintain as far as possible the objectivity imposed by the numerical methods, they are separated with a different generic name. *Aganotermes* has also long apical teeth, but the large size, very narrow meso- and metanota, ocelli distant from the eyes, and the short-necked unarmed enteric valve of the worker all distinguish this genus. There remain only *Amicotermes* and *Asagarotermes* with similar mandibles, both distinguished by the characteristic enteric valve armature of the worker. In the imago the former genus has smaller compound eyes than *Acholotermes*, and *Asagarotermes* has narrower meso- and metanota.

Keys to Species

Imagos

1 Postclypeus relatively weakly inflated, Pcl/W, 0·23–0·27 2
– Postclypeus very strongly inflated, Pcl/W, 0·31–0·34 3
2 Smaller, W, 0·84–0·90. Ocellus separated from compound eye by about half own least diameter, O_w/O–E, 1·93–2·04. Apical teeth of mandibles shorter, L_A/L_1, 0·72–0·82, R_A/R_1, 1·05 . . . . **chirotus** (p. 143)
– Larger, W, 0·99–1·03. Ocellus separated from compound eyes by almost own least diameter, O_w/O–E, 1·04–1·14. Apical teeth of mandibles longer, L_A/L_1, 0·91–1·04, R_A/R_1, 1·33–1·45 . . . . **tithasus** (p. 149)
3 Fontanelle short oval, about half diameter of ocellus, paler than head. Apical teeth of mandibles shorter, L_A/L_1, 0·68–0·76, R_A/R_1, 0·92–0·99. Mesonotum narrower at constriction, M/W, 0·25–0·28 . . . . **epius** (p. 144)
– Fontanelle vestigial, minute, circular, coloured as head. Apical teeth of mandibles longer, L_A/L_1, 0·89–0·91. R_A/R_1, 1·13–1·24. Mesonotum wider at constriction, M/W, 0·30–0·31 . . . . **imbellis** (p. 148)

Workers

1 Fore tibia slender, T_l/T_w, 5·25–5·30, third apical spur very small, one-quarter or less length of other two. Apical teeth of mandibles shorter, L_A/L_1, 0·81–0·82. R_A/R_1, 0·97–1·00. Mesenteric overlap at junction with proctodeum, length twice width of mesenteron at insertion of malpighian tubules . . . . . **epius** (p. 144)
– Fore tibia swollen, T_l/T_w, 3·91–4·27, third apical spur one-third or more length of other two. Apical teeth of mandibles longer, L_A/L_1, 0·89–1·07, R_A/R_1, 1·11–1·26. Mesenteric junction with proctodeum nearly transverse, slightly angled only, no overlap 2

2 Smaller, W, 0·70. Apical teeth of mandibles shorter, L_A/L_1, 0·89, R_A/R_1, 1·11. Enteric valve-seating dorso-lateral, near dorsal, in unopened abdomen . ***chirotus*** (p. 143)
– Larger, W, 0·80. Apical teeth of mandibles longer, L_A/L_1, 1·00–1·07. R_A/R_1, 1·18–1·29. Enteric valve-seating lateral in unopened abdomen 3
3 Postclypeus more strongly inflated, Pcl/W, 0·33. Fore tibia less swollen, T_1/T_w, 4·27 . . . . ***imbellis*** (p. 148)
– Postclypeus less inflated, Pcl/W, 0·28. Fore tibia slightly thicker, T_1/T_w, 3·92 ***tithasus*** (p. 149)

Acholotermes chirotus **sp. n.**

(Text-figs 340, 341, 348, 349 & 356–361; Pl. 3, figs 1& 2)

Imago. Head capsule sepia-brown, darker above ocelli; fontanelle very small, less than one-quarter size of ocellus, nearly flat, circular or short oval, pale brown; medial spot same size and shape as fontanelle, colour as head; postclypeus brown, labrum pale yellow-brown; frontal marks sepia-brown flat crescents; antennae yellow-brown. Pronotum, meso- and metanota, brown, transverse dark sutures present but weak on mesonotum; femora pale yellow brown, tibiae and tarsi yellow. Abdominal tergites brown, dorsal stigmata sepia-brown, sternites yellow-brown, yellow in middle, ventral stigmata brown; cerci yellow.

Posterior margin of head capsule widely and evenly rounded; ocelli fairly large, separated from compound eyes by only about half own least diameter; postclypeus moderately inflated, Pcl/W, 0·25–0·27, posterior margin bowed, not evenly rounded, median suture distinct. Apical teeth of mandibles rather long, L_A/L_1, 0·72–0·82, R_A/R_1, 1·05; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 12·88–14·20; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edge of first marginal approximately equal, to that of second. Pilosity of head capsule sepia-brown, uneven, not forming a pelt. Meso- and metanota fairly wide at constriction, M/W, 0·30. Fore tibia with third apical spur distinct, about one-third length of other two.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W)	0·84–0·90
Ocellus ($O_w \times O_l$)	0·07 × 0·10–0·11
Ocellus to eye (O–E)	0·03
Postclypeus length (Pcl)	0·21–0·24
Antennal article III	0·03
Antennal article IV	0·04
Antennal article V	0·04
Left mandible, apical to first marginal (L_A)	0·09–0·11
Left mandible, first to third marginal (L_1)	0·13
Left mandible, third marginal to molar (L_m)	0·06
Right mandible, apical to first marginal (R_A)	0·10–0·11
Right mandible, first to second marginal (R_1)	0·10
Right mandible, second marginal to molar (R_m)	0·06
Mesonotum width (M)	0·25–0·27
Metanotum width (N)	0·26–0·30

Worker. Head capsule pale yellow, pilosity yellow, fairly numerous setae. Postclypeus moderately inflated, Pcl/W, 0·30. Apical teeth of mandibles long, L_A/L_1, 0·81, R_A/R_1, 1·11; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, $L_A/L_1.L_m$, 22·30; anterior edge of first marginal tooth of right mandible shorter than that of second, $R_A/R_1.R_m$, 26·05. Fore tibia moderately swollen, T_1/T_w, 3·91, third apical spur distinct, about one-third length of other two. Mesenteric junction with proctodeum almost transverse, to right of malpighian knot; enteric valve seating dorsolateral in unopened abdomen; internal cushions of enteric valve weakly developed, with scaly surface, posterior margin of each scale fringed with numerous minute spicules. Membranous wall of valve beyond cushions with very numerous rather pronounced spicules arranged in 15–20 rows, broken up into fringed lobes between cushions. Other characters given in generic diagnosis.

Measurements (one specimen) in millimetres.

Head width (W)	0·70
Fore tibia width (T_w)	0·14
Fore tibia length (T_1)	0·54
Postclypeus length (Pcl)	0·21
Left mandible, apical to first marginal (L_A)	0·09
Left mandible, first to third marginal (L_1)	0·10
Left mandible, third marginal to molar (L_m)	0·04
Right mandible, apical to first marginal (R_A)	0·09
Right mandible, first to second marginal (R_1)	0·08
Right mandible, second marginal to molar (R_m)	0·04

A. chirotus is the smallest species in the genus, distinctly smaller than *A. tithasus* with which it is almost certainly sympatric. It also has, in the imago, proportionately larger ocelli closer to the compound eyes, and in both castes, shorter apical mandibular teeth. Both of the savanna species, *A. epius* and *A. imbellis*, have much more inflated postclypeus in the imago. In the worker caste, *A. epius* has a mesenteric overlap with the proctodeum and slender fore tibia; *A. imbellis* has again an inflated postclypeus and longer apical teeth. The worker abdomen of *A. chirotus* appears to be weakly dehiscent.

Holotype ♀ imago, paratype ♂ and ♀ imagos, and workers from type-colony, DEMOCRATIC REPUBLIC OF CONGO: Epulu River, Camp Putnam, 15.v.1948 (*A. E. Emerson*), in American Museum of Natural History. (Paratypes from type-colony, ♂ and ♀ imagos and workers in BMNH.)

The single known nest-series is recorded as having been found in a mound of *Acanthotermes acanthothorax* (Sjöstedt).

Acholotermes epius sp. n.

(Text-figs 342, 343, 350, 351 & 362–367; Pl. 3, fig. 3)

Imago. Head capsule dark sepia-brown, darker above ocelli; fontanelle small, about half size of ocellus, slightly depressed, short-oval, brown, medial spot slightly smaller, flat on slightly raised, short-oval, sepia-brown; postclypeus sepia-brown, labrum yellow-brown; frontal marks sepia-brown, somewhat weakly marked, flat crescents; antennae yellow-brown. Pronotum,

meso- and metanota, sepia-brown, transverse dark sutures distinct; femora yellow-brown, tibiae paler, tarsi yellow. Abdominal tergites sepia-brown with darker dorsal stigmata, sternites brown laterally, pale yellow-brown in middle, ventral stigmata sepia-brown; cerci pale yellow-brown.

Posterior margin of head capsule slightly undulating, not quite evenly rounded; ocelli medium sized, separated from compound eyes by slightly less than half up to two-thirds own least diameter; postclypeus strongly inflated, Pcl/W, 0·31–0·33, posterior margin evenly rounded, median suture strongly developed. Apical teeth of mandibles fairly long, L_A/L_1, 0·68–0·76, R_A/R_1, 0·92–0·99; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 11·59–12·18; point of first marginal tooth of right mandible only very slightly behind line of apical to second marginal, anterior edge of first marginal distinctly longer than that of second. Pilosity of head capsule sepia-brown, rough, uneven, not forming a pelt. Meso- and metanota rather narrow at constriction, M/W, 0·25–0·28. Fore tibia with third apical spur vestigial, one-fifth or less length of other two (in type-series, specimens from another colony have them well developed).

Measurements (four specimens from two localities) in millimetres.

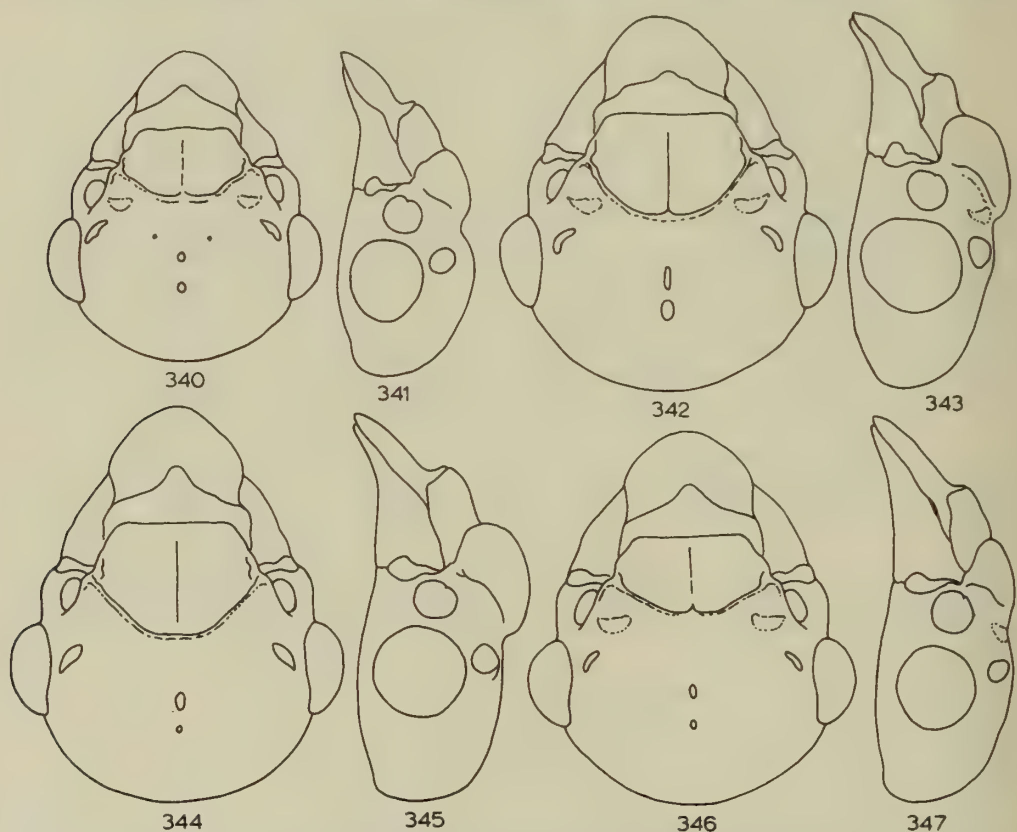
	Range	Mean
Head width across eyes (W) .	0·98–1·06	1·015
Ocellus ($O_w \times O_l$). . .	0·08–0·09 × 0·10–0·11	0·080 × 0·106
Ocellus to eye (O–E) . .	0·04–0·06	0·048
Postclypeus length (Pcl) .	0·30–0·35	0·321
Antennal article III . .	0·03–0·04	0·030
Antennal article IV . .	—	0·047
Antennal article V . .	—	0·051
Left mandible, apical to first marginal (L_A) . . .	0·11–0·12	0·111
Left mandible, first to third marginal (L_l) . . .	0·15–0·16	0·156
Left mandible, third marginal to molar (L_m) . . .	—	0·060
Right mandible, apical to first marginal (R_A) . . .	0·10–0·12	0·110
Right mandible, first to second marginal (R_l) . . .	0·11–0·12	0·113
Right mandible, second marginal to molar (R_m) . .	0·06–0·07	0·066
Mesonotum width (M) . .	0·24–0·29	0·271
Metanotum width (N) . .	0·23–0·30	0·272

Worker. Head capsule and pilosity pale yellow, setae sparse. Postclypeus strongly inflated, Pcl/W, 0·33–0·35. Apical teeth of mandibles long, L_A/L_1, 0·81–0·82, R_A/R_1, 0·97–1·00; subsidiary marginal tooth of left mandible well clear of molar prominence, separated from it by distinct notch in surface view, $L_A/L_1.L_m$, 20·75–21·20; anterior edges of first and second marginal teeth subequal, $R_A/R_1.R_m$, 22·80. Fore tibia scarcely swollen. T_l/T_w, 5·25–5·30, third spur vestigial, one-quarter or less of length of other two. Mesenteric overlap with proctodeum approximately twice as long as width of mesenteron at insertion of malpighian tubules, anterior end of proctodeum touching malpighian knot; enteric valve seating dorsolateral in unopened abdomen; internal cushions of enteric valve all equally fairly distinctly developed, with scaly surface, posterior margin of each scale bearing one small point or spine. Membranous wall of valve beyond cushions with numerous minute spicules tending to be arranged in rows. Other characters in generic diagnosis.

Measurements (two specimens from two localities) in millimetres:

Head width (W)	0·73–0·76
Fore tibia width (T_w)	0·10–0·11
Fore tibia length (T_l)	0·53–0·56
Postclypeus length (Pcl)	0·25
Left mandible, apical to first marginal (L_A)	0·09
Left mandible, first to third marginal (L_l)	0·11
Left mandible, third marginal to molar (L_m)	0·04
Right mandible, apical to first marginal (R_A)	0·09
Right mandible, first to second marginal (R_l)	0·09
Right mandible, second marginal to molar (R_m)	0·04

A. epius has already been compared with *A. chirotus* in the discussion on that species. It is about the same size as *A. tithasus*, but has a much more inflated postclypeus in both imago and worker castes, and the ocelli are closer to the compound eyes. *A. epius* is the only species of the genus which in the worker has a mesenteric overlap with the proctodeum, and a vestigial third apical spur on the slender fore tibia. There is a little doubt about this character in the imago, since although the third spur is vestigial in the type-series, it is fully developed in another



FIGS 340–347. *Acholotermes*, imago head capsules, front and side views. 340, 341, *A. chirotus*; 342, 343, *A. epius*; 344, 345, *A. imbellis*; 346, 347, *A. tithasus*.

imago pair that appear conspecific. *A. imbellis* is distinguished in the imago by the minute fontanelle, longer apical mandibular teeth, and wider meso- and metanota. The worker differs from *A. epius* in the characters already mentioned above. The abdomen appears to be possibly dehiscent in the worker caste of *A. epius*, but this is not very definite.

Holotype ♀ imago, paratype ♂ and ♀ imagos and workers from type-colony, ZAMBIA: Lusaka, 11.xii.1966 (*M. G. Bingham*, Coll. No. 553) in British Museum (Natural History).

Other paratype material. RHODESIA: Salisbury, Atlantika Research Station, 19.xii.1964 (*M. G. Bingham*, Coll. No. 158), in BMNH.

The species was found in mounds of *Cubitermes* spp.

FIGS 348–355. *Acholotermes*, imago mandibles. 348, 349, *A. chirotus*; 350, 351, *A. epius*; 352, 353, *A. imbellis*; 354, 355, *A. tithasus*.

Acholotermes imbellis sp. n.

(Text-figs 344, 345, 352, 353 & 368–373; Pl. 3, fig. 4)

Imago. Head capsule sepia-brown, darker above ocelli; fontanelle vestigial, minute, circular, flat or very slightly depressed and coloured as head; medial spot oval, slightly raised, larger than fontanelle, also coloured as head; postclypeus brown, labrum pale yellow-brown; frontal marks small, flat, semicircular, sepia-brown; antennae yellow-brown. Pronotum, meso- and metanota brown, transverse dark sutures present; femora yellow-brown, tibiae paler, tarsi yellow. Abdominal tergites brown, dorsal stigmata sepia-brown, sternites yellow-brown, paler in middle, ventral stigmata brown; cerci yellow.

Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by less than half own least diameter; postclypeus strongly inflated, Pcl/W, 0·32–0·34, posterior margin bowed, not evenly rounded, median suture present, weak anteriorly. Apical teeth of mandibles long, L_A/L_1, 0·89–0·91, R_A/R_1, 1·13–1·24; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 12·67–14·22; point of first marginal tooth of left mandible slightly behind line of apical to second marginal, anterior edges of first and second marginals approximately equal. Pilosity of head capsule uneven, not forming a pelt, brown. Meso- and metanota fairly wide at constriction. M/W, 0·30–0·31. Fore tibia with third apical spur distinct, about two-thirds length of other two.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W)	0·97–1·06
Ocellus ($O_w \times O_l$)	0·08–0·09 × 0·10–0·11
Ocellus to eye (O–E)	0·04
Postclypeus length (Pcl)	0·31–0·36
Antennal article III	0·02–0·03
Antennal article IV	0·03–0·04
Antennal article V	0·05
Left mandible, apical to first marginal (L_A)	0·13
Left mandible, first to third marginal (L_1)	0·14
Left mandible, third marginal to molar (L_m)	0·06–0·07
Right mandible, apical to first marginal (R_A)	0·13
Right mandible, first to second marginal (R_1)	0·10–0·11
Right mandible, second marginal to molar (R_m)	0·06–0·07
Mesonotum width (M)	0·29–0·33
Metanotum width (N)	0·30–0·35

Worker. Head capsule pale yellow, pilosity yellow, rather dense on both head and body. Postclypeus strongly inflated, Pcl/W, 0·33. Apical teeth of mandibles very long, L_A/L_1, 1·00, R_A/R_1, 1·18; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, $L_A/L_1.L_m$, 22·89; anterior edges of first and second marginal teeth of right mandible approximately equal, $R_A/R_1.R_m$, 23·50. Fore tibia weakly swollen, T_l/T_w, 4·27, third apical spur distinct, about half length of other two. Mesenteric junction with proctodeum angled between transverse and diagonal, touching malpighian knot; enteric valve seating lateral in unopened abdomen; internal cushions of enteric valve moderately developed, with scaly

surface, posterior margin of each scale fringed with minute spicules. Membranous wall of valve beyond cushions with very numerous fine small spicules arranged in 15–20 rows, broken up into fringed lobes, between cushions. Other characters in generic diagnosis.

Measurements (one specimen) in millimetres.

Head width (W)	0·80
Fore tibia width (T_w)	0·14
Fore tibia length (T_l)	0·59
Postclypeus length (Pcl)	0·26
Left mandible, apical to first marginal (L_A)	0·11
Left mandible, first to third marginal (L_1)	0·11
Left mandible, third marginal to molar (L_m)	0·04
Right mandible, apical to first marginal (R_A)	0·11
Right mandible, first to second marginal (R_1)	0·09
Right mandible, second marginal to molar (R_m)	0·05

A. imbellis has already been compared with *A. chirotus* and *A. epius* under those species. It is distinguished from *A. tithasus* in both imago and worker castes by its much more strongly inflated postclypeus, and in the imago by the ocelli being much closer to the eyes. In the worker caste, *A. tithasus* also has noticeably bristly fore coxae in contrast to *A. imbellis*. The abdomen of the worker caste appears to be dehiscent in this species.

Holotype queen, paratype king, and workers from type-colony, DEMOCRATIC REPUBLIC OF CONGO: Katanga, Keyberg, near Elizabethville, 21.v.1948 (*A. E. Emerson*), in American Museum of Natural History.

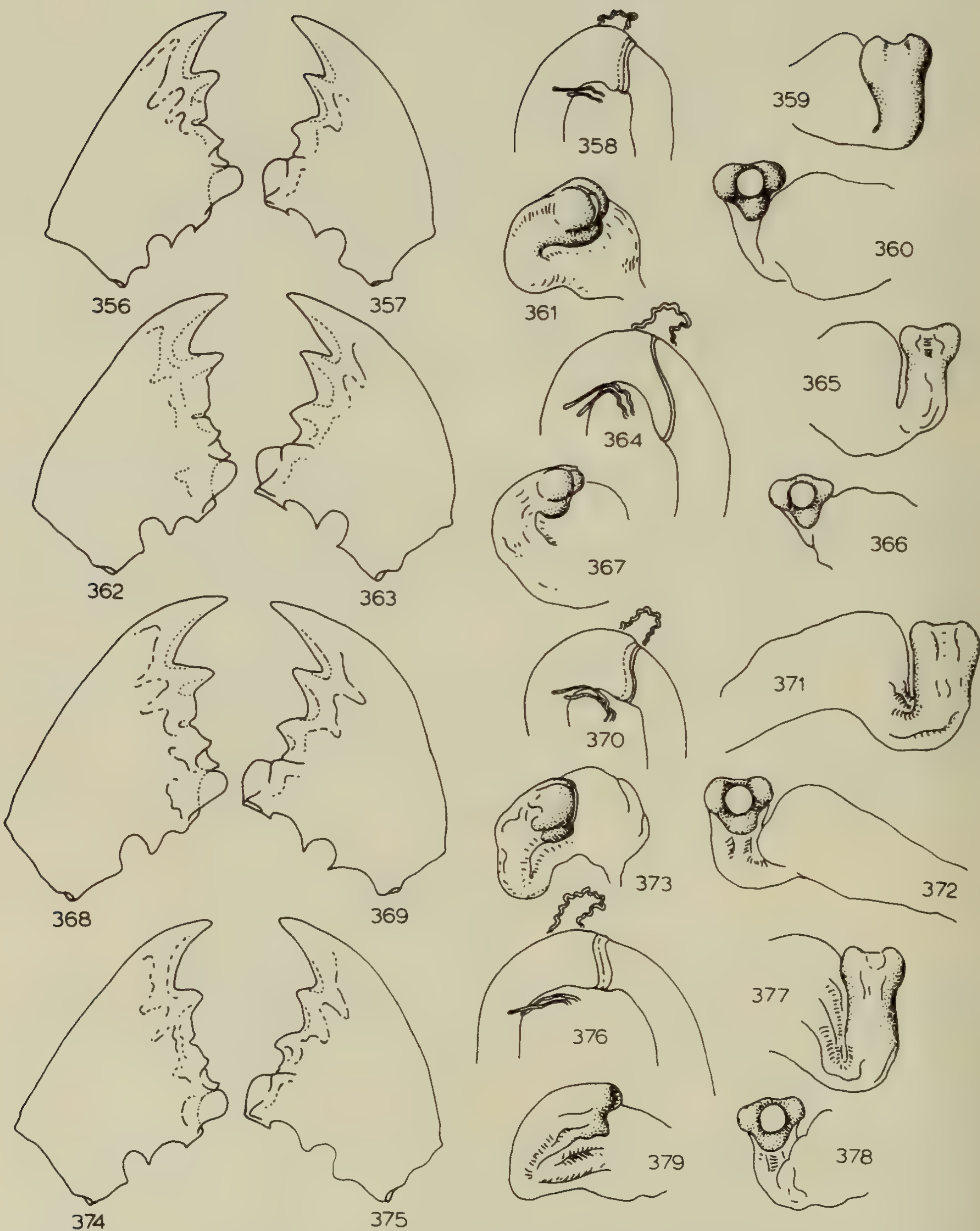
The single known nest-series was found near the surface of an old mound, probably of *Cubitermes* sp., in grassy woods near the top of a rocky hillside.

Acholotermes tithasus sp. n.

(Text-figs 346, 347, 354, 355 & 374–379; Pl. 3, figs 5 & 6)

Imago. Head capsule sepia-brown, darker above ocelli; fontanelle small, circular, flat, less than one-fifth size of ocellus, pale brown; medial spot twice as large as fontanelle, flat, coloured as head; postclypeus sepia-brown, labrum yellow-brown; frontal marks flat crescents, coloured as head; antennae brown. Pronotum sepia-brown, meso- and metanota brown, transverse dark sutures absent from mesonotum, weakly present on metanotum; femora and tibiae pale yellow-brown, tarsi yellow. Abdominal tergites brown, dorsal stigmata paler, sternites yellow-brown laterally with paler ventral stigmata, yellow in middle; cerci yellow.

Posterior margin of head capsule slightly arched, not evenly rounded; ocelli rather small, separated from compound eyes by slightly more than own least diameter; postclypeus weakly inflated, Pcl/W, 0·23, posterior margin almost obtusely angular, not evenly rounded, median suture weak. Apical teeth of mandibles very long, L_A/L_1, 0·91–1·04, R_A/R_1, 1·33–1·45; subsidiary marginal tooth of left mandible level with edge of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 13·50–16·29; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edges of first and second marginals equal.



FIGS 356–379. *Acholotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seatings. 356–361, *A. chirotus*; 362–367, *A. epius*; 368–373, *A. imbellis*; 374–379, *A. tithasus* (mandibles somewhat worn).

Pilosity of head capsule uneven, not forming a pelt. Meso- and metanota fairly wide at constriction, M/W, 0·30–0·32. Fore tibia with third apical spur nearly as long as other two.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W)	0·99–1·03
Ocellus ($O_w \times O_l$)	0·07 × 0·09
Ocellus to eye (O–E)	0·06–0·07
Postclypeus length (Pcl)	0·25–0·24
Antennal article III	0·05–0·06
Antennal article IV	0·05
Antennal article V	0·05
Left mandible, apical to first marginal (L_A)	0·14–0·15
Left mandible, first to third marginal (L_1)	0·14–0·15
Left mandible, third marginal to molar (L_m)	0·06–0·07
Right mandible, apical to first marginal (R_A)	0·15
Right mandible, first to second marginal (R_1)	0·10–0·11
Right mandible, second marginal to molar (R_m)	0·06–0·08
Mesonotum width (M)	0·31
Metanotum width (N)	0·33–0·35

Worker. Head capsule and pilosity yellow. Postclypeus moderately inflated, Pcl/W, 0·28. Apical teeth of mandibles very long, L_A/L_1, 1·07, R_A/R_1, 1·29; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, $L_A/L_1.L_m$, 22·55; anterior edge of first marginal tooth of right mandible shorter than that of second, $R_A/R_1.R_m$, 30·15. Fore tibia moderately swollen, T_l/T_w, 3·92, third apical spur about two-thirds length of other two. Mesenteric junction with proctodeum transverse, to right of malpighian knot; enteric valve-seating lateral or slightly dorsolateral in unopened abdomen; internal cushions of enteric valve moderately developed, with scaly surface, posterior margin of each scale fringed with several small spines. Membranous wall of valve beyond cushions with very numerous fine but distinct spicules arranged in 15–20 rows, only slightly broken into fringed lobes between posterior ends of cushions. Other characters in generic diagnosis.

Measurements (one specimen) in millimetres.

Head width (W)	0·80
Fore tibia width (T_w)	0·15
Fore tibia length (T_l)	0·59
Postclypeus length (Pcl)	0·23
Left mandible, apical to first marginal (L_A)	0·11
Left mandible, first to third marginal (L_1)	0·11
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A)	0·11
Right mandible, first to second marginal (R_1)	0·09
Right mandible, second marginal to molar (R_m)	0·04

The comparisons of this, the type-species, with the remaining members of the genus, have already been made under their individual headings. The abdomen seems to be weakly dehiscent in the worker caste of *A. tithasus*.

Holotype ♀ imago, paratype ♂ and ♀ imagos and workers from type-colony, Democratic Republic of Congo: Yangambi, 29.v.1948 (*A. E. Emerson*), in American Museum of Natural History. (Paratypes from type-colony, ♀ and ♂ imagos and workers, also in BMNH.)

The single known nest-series was found in a mound 5 ft in diameter, 3 ft high, at the base of a tree.

AMICOTERMES gen. n.

(Amicus, L., 'friend(ly), kind')

Type-species: *Amicotermes galenus* sp. n.

Imago. Medium-sized, W, 1·01. Compound eyes proportionately rather small, W/E, 4·5 (all other genera and species under 4·2, most under 4·0). Fore tibia with three apical spurs, third very small, almost vestigial; fore coxae thickly setose, somewhat spiny on anterior edge. Apical teeth of mandibles very long, L_A/L_1, 0·99. R_A/R_1, 1·36; subsidiary marginal tooth of right mandible with proximal end just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 14·08. Point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edges of first and second marginals subequal. Meso- and metanota rather narrow at constriction, M/W, 0·28, transverse dark sutures absent; complex ratio of mandible and notal measurements, L_1/M.N, 1·60.

Worker. Medium-sized, W, 0·76. Fore tibia weakly swollen, T_1/T_w, 4·32, with three apical spurs, third spur small, about one-third other two; fore coxae and rest of leg strongly setose, bristly, apex of tibia and base of femur with opposing interlocking bristles when folded (only genus in which this is found). Apical teeth of mandibles very long, L_A/L_1, 1·09, R_A/R_1, 1·33; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio $L_A/L_1.L_m$, 26·50; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edges of first and second marginals subequal, complex ratio, $R_A/R_1.R_m$, 31·25. Mesenteric junction with proctodeum nearly transverse, slightly angled, to right of malpighian knot. Enteric valve seating definitely three-lobed, third lobe only slightly smaller than outer two, connected to second pouch of proctodeum by very long neck, lateral in position in unopened abdomen; internal cushions of enteric valve produced through valve opening, those in position 3 slightly more elongated than the others, all positions armed in posterior one-third of length with numerous irregularly arranged elongated spines; rest of cushion surface scaly, most scales edged with small or minute spines. Membranous wall of valve beyond cushions with numerous fine but pronounced spicules, between cushions with numerous spicule-fringed carunculations.

Amicotermes was at first grouped with *Acholotermes* on the basis of the similarity of the imago and worker mandibles, and the layout of the worker gut. However, the worker enteric valve-armature is much more developed, and the imago rather different in appearance with its unusually small compound eyes. The spiny or setose coxae of worker and imago are another unusual feature supporting the placement of the single species in a monotypic genus. The vector and cluster analyses of the similarity matrix also separate it widely from *Acholotermes*. The enteric valve armature of *Amicotermes* is superficially similar to that of *Apagotermes*, but in the latter genus the imago and worker mandibles are quite different, and the valve

armature consists of regularly arranged spines, those below the outermost row being slightly spatulate. In the cluster analysis *Amicotermes* is placed near *Aderitotermes*. This genus, however, has a long mixed segment and distinctive enteric valve-armature in the worker caste, shorter mandibular apical teeth in both castes, and regular pilosity forming a pelt on the head capsule of the imago. *Adynatotermes* has similarly long apical teeth but is otherwise very different, not least in size.

Since the decision to separate *Amicotermes* as a monotypic genus was taken a second species has been discovered in West Africa. This is known only from the worker caste, and is therefore not described here, as in other genera where the same thing has happened. The occurrence of these extra species in monotypic or small genera is interesting because they strengthen the conviction that the generic groupings used here will form a valid and stable basis for their future classification.

Amicotermes galenus sp. n.

(Text-figs 380–389; Pl. 3, figs 7–10)

Imago. (Queen, colours possibly faded.) Head capsule sepia-brown, darker above ocelli; fontanelle flat, short oval, pale yellow, about half size of ocellus; medial spot circular, flat, slightly smaller than fontanelle, coloured as head; postclypeus brown, labrum yellow; frontal marks semicircular, flat, brown; antennae pale yellow-brown. Pronotum brown, meso- and metanota yellow-brown, femora and tibiae yellow, tarsi paler. Abdominal tergites yellow-brown, dorsal stigmata paler, sternites pale yellow-brown, ventral stigmata and middle fo sternites paler; cerci yellow.

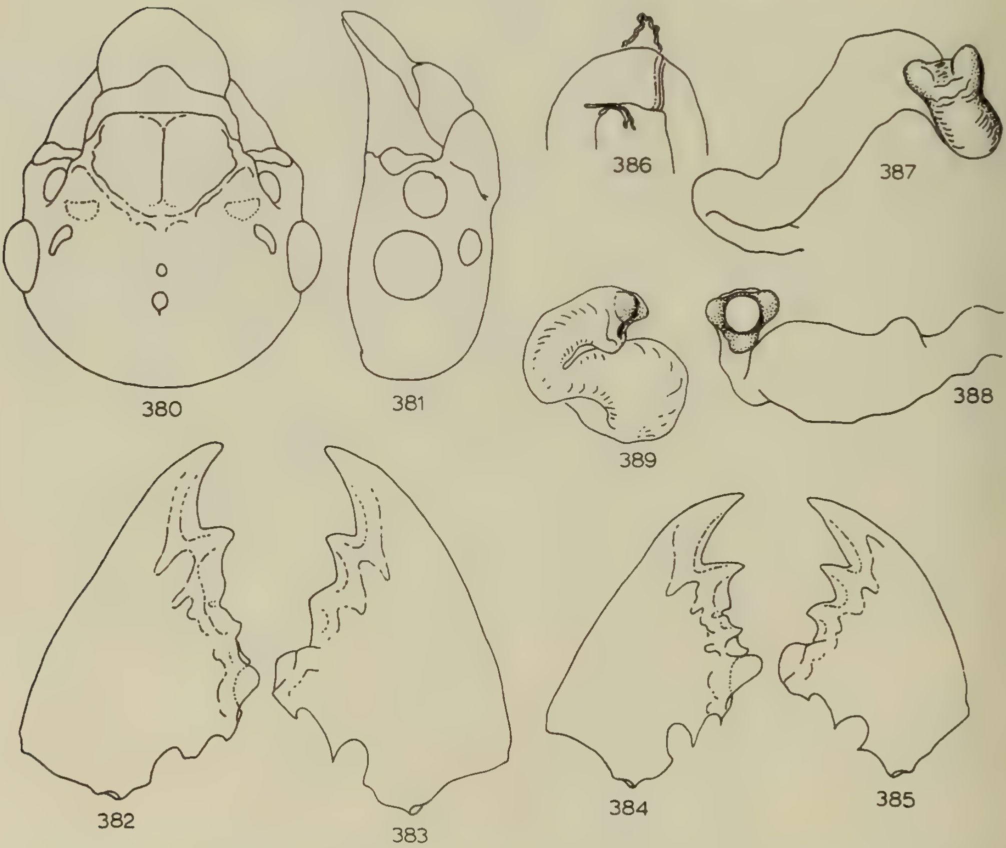
Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by somewhat less than own least diameter; postclypeus strongly inflated, Pcl/W, 0·33, posterior margin rather angularly arched, median suture distinct. Pilosity of head capsule very dense, yellow-brown, somewhat uneven, almost forming a pelt but obscured by many emergent setae. Other characters in generic diagnosis.

Measurements (one specimen) in millimetres.

Head width across eyes (W)	1·01
Ocellus ($O_w \times O_l$)	0·09 × 0·12
Ocellus to eye (O–E)	0·07
Postclypeus length (Pcl)	0·34
Antennal article III	0·04
Antennal article IV	0·05
Antennal article V	0·05
Left mandible, apical to first marginal (L_A)	0·14
Left mandible, first to third marginal (L_1)	0·14
Left mandible, third marginal to molar (L_m)	0·07
Right mandible, apical to first marginal (R_A)	0·14
Right mandible, first to second marginal (R_1)	0·10
Right mandible, second marginal to molar (R_m)	0·07
Mesonotum width (M)	0·29
Metanotum width (N)	0·30

Worker. Head capsule and pilosity yellow, setae rather sparse, not conspicuous. Postclypeus strongly inflated, Pcl/W, 0·33, Pcl/R_l, 3·28. Other characters given in generic diagnosis.
Measurements (one specimen) in millimetres.

Head width (W)	0·76
Fore tibia width (T_w)	0·13
Fore tibia length (T_l)	0·56
Postclypeus length (Pcl) . . .	0·25
Left mandible, apical to first marginal (L_A)	0·10
Left mandible, first to third marginal (L_l) .	0·10
Left mandible, third marginal to molar (L_m)	0·04
Right mandible, apical to first marginal (R_A)	0·10
Right mandible, first to second marginal (R_l)	0·08
Right mandible, second marginal to molar (R_m)	0·04



FIGS 380–389. *Amicotermes galenus.* 380, 381, front and side views of imago head capsule; 382, 383, imago mandibles; 384, 385, worker ditto; 386, mesenteric-proctodeal junction showing attachments of malpighian tubules and position of malpighian knot; 387–389, views of enteric valve seating.

The distinguishing features of this species are discussed under the generic headings. It remains only to note that the abdomen of the worker caste appears to be dehiscent in *A. galenus*.

Holotype ♀ imago (queen) and paratype workers from type-colony only, DEMOCRATIC REPUBLIC OF CONGO: Katanga, Keyberg, near Elizabethville, 21.v.1948 (*A. E. Emerson*) in American Museum of Natural History.

The single nest-series of this species, like that of *Acholotermes imbellis*, was found in an old mound, probably of *Cubitermes*, on a rocky hillside in grassy woodland.

APAGOTERMES gen. n.

(Apages, Gr., 'soft, weak')

Type-species: *Apagotermes stolidus* sp. n.

Imago. Small-sized, W, 0·74. Fore tibia with three apical spurs, third nearly equal in size to other two. Apical teeth of mandibles short, L_A/L_l, 0·55, R_A/R_l, 0·67–0·71; subsidiary marginal tooth of left mandible with proximal end just clear of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 9·09–9·50; points of apical and marginal teeth of right mandible nearly in line, anterior edge of first marginal shorter than that of second, the latter curved. Meso- and metanota narrow at constriction, M/W, 0·21, transverse dark sutures present, weak on mesonotum; complex ratio of mandible and notal measurements, L_l/M.N, 4·36–4·70.

Worker. Very small, W, 0·58. Fore tibia moderately swollen, T_l/T_w, 3·84 with three apical spurs, third about half other two. Apical teeth of mandibles short, L_A/L_l, 0·52, R_A/R_l, 0·67; subsidiary marginal tooth of left mandible with proximal end level with edge of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 12·70; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal shorter than that of second, complex ratio, $R_A/R_l.R_m$, 15·80. Mesenteric junction with proctodeum very nearly transverse, to right of malpighian knot. Enteric valve-seating weakly three-lobed, two outer lobes tending to be opposite, but no longer than third, connected to second pouch of proctodeum by distinct but very short neck, dorsolateral in position in unopened abdomen; internal cushions of enteric valve all equally produced through valve opening; all positions armed in posterior one-third of length with regularly arranged rows of elongated spines, those below outermost row somewhat spatulate or ensiform, alternate cushions, i.e., positions 1 and 3, with slightly fewer spines; rest of cushion surface with small or minute spines.

The small size of *Apagotermes* distinguishes it from many other genera including the previous genus, *Amicotermes* in which the worker enteric valve is superficially similar. Other distinguishing features are given under that genus. The imago of *Astalotermes obstructus* resembles *Apagotermes* but has a somewhat longer postclypeus, wider meso- and metanota, and ocelli closer to the eyes. The workers are easily distinguished by the gut characters. *Astalotermes benignus* has a similar size range, but the vestigial third tibial spur is diagnostic. In the smaller *Astalotermes* species, there seems to be less discrepancy in size between imago and worker castes than there is in *Apagotermes*. *Astalotermes comis* is again about the same size but the mandibular teeth are very differently proportioned and the postclypeus more inflated.

Apagotermes is one of the most isolated genera and species in the cluster analyses of the similarity matrix. It is the last to join in the single linkage, and penultimate

in the median sorting. In the vector analyses it seems not so much an outlier as a genus which is isolated by falling in a 'gap' in the hyperspace. It has an unusual combination of values for the first five or six principal co-ordinates, although no individual value in any vector approaches the extremes.

Apagotermes stolidus sp. n.

(Text-figs 390–399; Pl. 4, figs 1 & 2)

Imago. Head capsule sepia-brown, darker above ocelli, fontanelle very small, almost vestigial, elongate oval, very slightly raised, brown; medial spot elongate oval, equal to fontanelle or slightly smaller, raised on small bump, coloured as head; postclypeus brown, labrum pale yellow-brown; frontal marks weakly developed, rather indistinct, flat brown crescents; antennae yellow-brown. Pronotum brown, meso- and metanota yellow-brown; femora pale yellow-brown, tibiae and tarsi yellow. Abdominal tergites brown, dorsal stigmata paler, sternites and ventral stigmata pale brown; middles of sternites and cerci yellow.

Posterior margin of head capsule slightly undulating, not evenly rounded; ocelli moderately large, separated from compound eyes by about two-fifths own least diameter; postclypeus very weakly inflated, Pcl/W, 0·21, posterior margin indistinctly arched, median suture absent. Pilosity of head capsule dense, somewhat uneven but almost forming a rough pelt with numerous irregular emergent setae. Other characters in generic diagnosis.

Measurements (two specimens, one locality) in millimetres.

Head width across eyes (W)	0·74
Ocellus ($O_w \times O_l$)	0·07 × 0·09
Ocellus to eye (O–E)	0·03
Postclypeus length (Pcl)	0·15–0·16
Antennal article III	0·02
Antennal article IV	0·03–0·04
Antennal article V	0·04
Left mandible, apical to first marginal (L_A)	0·06–0·07
Left mandible, first to third marginal (L_1)	0·12
Left mandible, third marginal to molar (L_m)	0·06
Right mandible, apical to first marginal (R_A)	0·07
Right mandible, first to second marginal (R_1)	0·09–0·10
Right mandible, second marginal to molar (R_m)	0·05–0·06
Mesonotum width (M)	0·16
Metanotum width (N)	0·16–0·17

Worker. Head capsule yellow, pilosity orange-yellow, fairly numerous but not dense, short, not conspicuous. Postclypeus weakly inflated, Pcl/W, 0·25, Pcl/R_1, 1·80. Other characters given in generic diagnosis.

Measurements (one specimen) in millimetres.

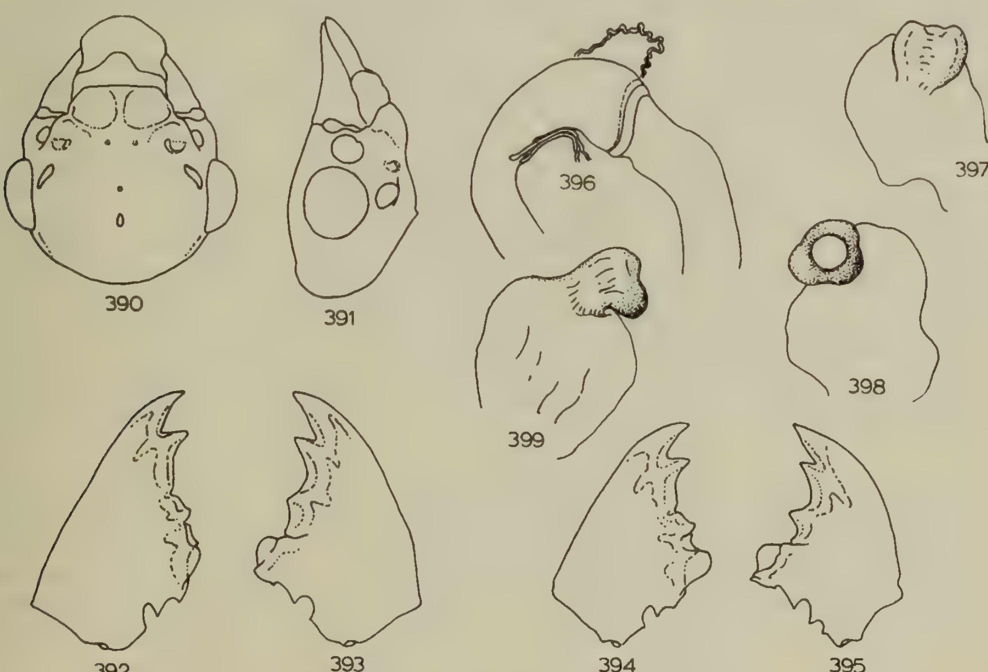
Head width (W)	0·58
Fore tibia width (T_w)	0·10
Fore tibia length (T_l)	0·38
Postclypeus length (Pcl)	0·14

Left mandible, apical to first marginal (L_A)	0·05
Left mandible, first to third marginal (L_1) .	0·10
Left mandible, third marginal to molar (L_m)	0·04
Right mandible, apical to first marginal (R_A).	0·05
Right mandible, first to second marginal (R_1)	0·08
Right mandible, second marginal to molar (R_m)	0·04

The comparisons of *A. stolidus* with other species and genera having been made under the generic heading, it remains to add that the abdomen of the worker caste has at least a tendency to be dehiscent.

Holotype ♀ imago, paratype ♂ and ♀ imagos and workers from type-colony, DEMOCRATIC REPUBLIC OF CONGO: Epulu River, Camp Putnam, 12.v.1948 (*A. E. Emerson*, Coll. No. 18) in American Museum of Natural History. (Other paratype ♂ and ♀ imago and workers from type-colony in BMNH.)

Other paratype material. NIGERIA: Eastern Region (*W. Wilkinson*) in British



FIGS 390–399. *Apagotermes stolidus*. 390, 391, front and side views of imago head capsule; 392, 393, imago mandibles; 394, 395, worker ditto; 396, mesenteric-proctodeal junction showing attachment of malpighian tubules and position of malpighian knot; 397–399, views of enteric valve seating.

Museum (Natural History). DEMOCRATIC REPUBLIC OF CONGO: Kivu, Irangi, 2.xi.1963 (*E. Ernst*) Swiss Tropical Institute, Basle and BMNH.

The type-series was found in the top 3–4 inches of soil on a mound of *Protermes prorepens* (Macrotermitinae) in rain forest.

ATEUCHOTERMES gen. n.

(Ateuches, Gr., 'unarmed')

Type-species: *Ateuchotermes pectinatus* sp. n.

Imago. Medium-sized to large, W, 0·90–1·30. Fore tibia with three apical spurs, third well developed, one-third or more length of other two, except in one species in which it is vestigial. Apical teeth of mandibles short or fairly short, L_A/L_l, 0·50–0·66, R_A/R_l, 0·66–1·01; subsidiary marginal tooth of left mandible with proximal end just clear to widely clear of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 5·33–9·10; points of apical and marginal teeth of right mandible in line, or first marginal retracted slightly behind line of apical to second marginal, anterior edge of first marginal equal to that of second, or longer. Meso- and metanota rather narrow to distinctly wider at constriction, M/W, 0·26–0·34, transverse dark sutures weak or absent on mesonotum in most species, only distinct in one, present or absent on metanotum; complex ratio of mandible and notal measurements, L_l/M.N, 1·07–1·92.

Worker. Medium sized to very large, W, 0·75–1·10. Fore tibia scarcely swollen or slender, T_l/T_w, 4·72–5·90, with three apical spurs, third small or vestigial, maximum about one-third of other two. Apical teeth of mandibles short to moderately long, L_A/L_l, 0·45–0·74, R_A/R_l, 0·59–1·01; subsidiary marginal tooth of left mandible with proximal end level with edge of molar prominence (one species only) or distinctly clear of it in surface view, complex ratio, $L_A/L_l.L_m$, 8·32–14·41; points of apical and marginal teeth of right mandible more or less in line, or first marginal distinctly retracted behind line of apical to second marginal, anterior edge of first marginal equal to that of second or markedly shorter, complex ratio, $R_A/R_l.R_m$, 10·40–17·10. Mesenteric junction with proctodeum diagonal or a little longer, to right of malpighian knot. Enteric valve-seating rather large, weakly two-lobed, sessile on second pouch of proctodeum or connected to it by short neck, dorsolateral to dorsal in unopened abdomen; internal cushions of enteric valve all sclerotized and produced through valve opening, that in position 1 enlarged, elongated, and dilated at its posterior end which curves out into enteric valve seating; armature in position 1 numerous elongated spines in comb- or rake-like formation in one or more rows round rim; armature in positions 2, 3 and 4 elongated, more slender spines, sometimes hooked at tips, fewer in number than position 1, in fork-like formation at posterior ends of cushions; all cushions sometimes with small spines on remainder of length or without further armature.

The enteric valve armature of the worker caste of *Ateuchotermes* is the most complex in the entire group and the most easily recognized. The function of this fantastic structure can only be a source of speculation. The cushion in position 1 has elongated to an extent where it hooks out of the enteric valve itself into its seating. Its spines touch the wall of the seating, where in one species a sclerotized cup has developed to receive them. The teeth of this structure are too far out to act as a filter. Only two possibilities suggest themselves. It could hold a colony of symbiotic bacteria against the wall of the gut and prevent their dispersion; or it could form a springy linking device to prevent the enteric valve pulling out of its seating. This in some other genera it seems to do very easily, in preserved material, being almost impossible to keep in place in dissections. It may be envisaged that

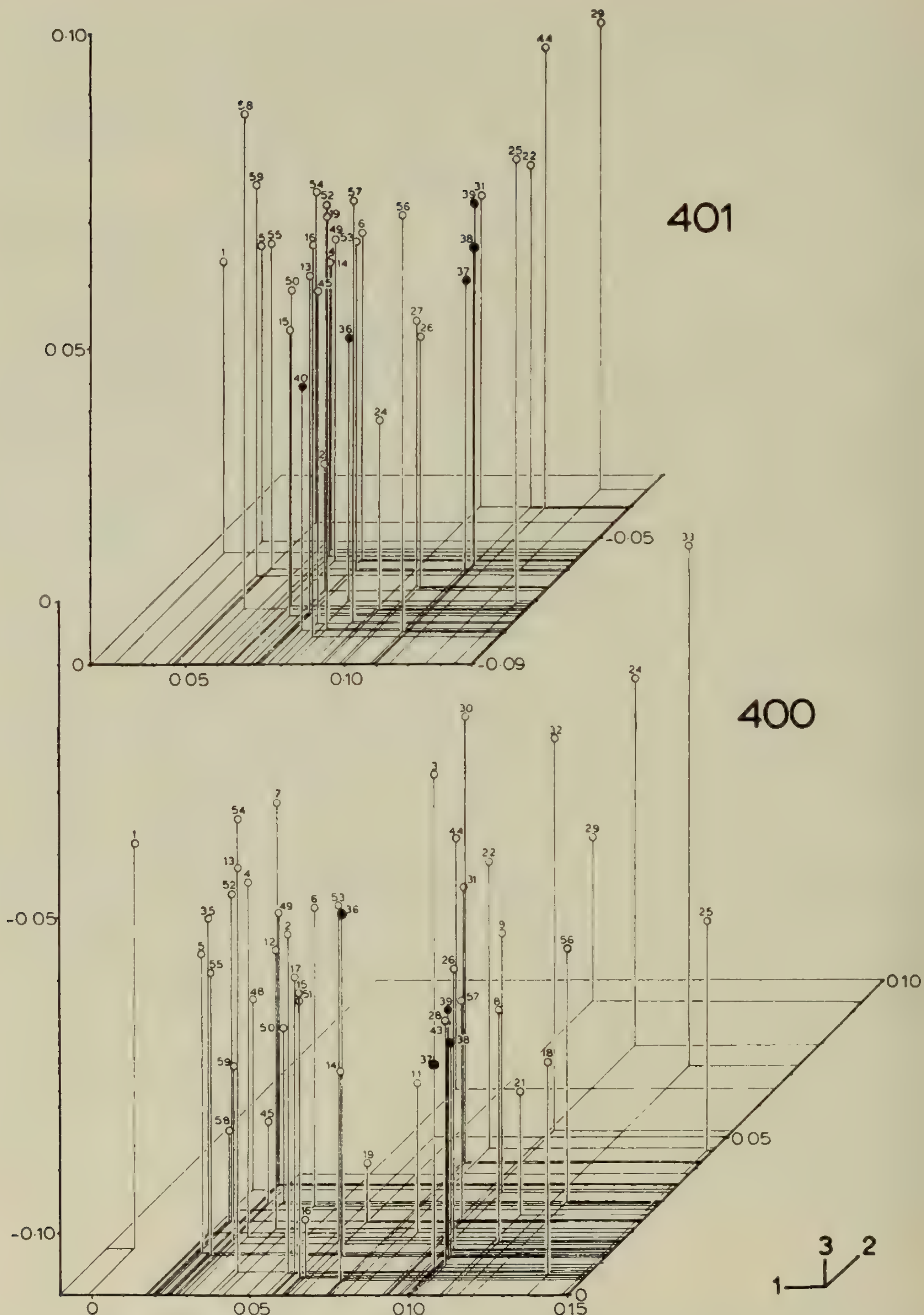
an easily ruptured gut might be an advantageous adjunct of a dehiscent abdomen as a suicidal defence mechanism. The abdomen certainly appears to be dehiscent to a very marked extent in all species of *Ateuchotermes*. However, in the narrow tunnels and crannies of their habitat the muscular contortions of their movements might set off the mechanism prematurely, and it could well be that this development took place to counteract the over-developed suicidal tendency. The connection would also tend to rupture more abruptly under the hydrostatic pressure, resulting in a more effective defensive explosion. Whatever its function, this structure provides a set of extremely valuable taxonomic characters. The spines on cushions in positions 2, 3 and 4 are clearly a development of the simple backwardly directed non-return mechanism seen in many other genera. In some species they appear to be capable of forming a filtering network held together by hooks at their tips. Within the genus *Ateuchotermes* these structures form a sequence of developing elaboration. A further species is known in which all cushion positions are developed to about the same extent, and like positions 2, 3 and 4. This would seem to indicate a relationship with other genera such as *Apagotermes* and possibly *Amicotermes*. The enteric valve of this species is included in the illustrations of the genus to show the relationship, but since only the worker caste is available it is not described or included in keys (Pl. 4, figs 3 & 4).

Ateuchotermes is one of the more compact and well-defined genera in the cluster and vector analyses (Text-fig. 402) of the similarity matrix. In both single linkage and median sorting the group forms above the 80% phenon level, 86% in the case of single linkage and joins with related groups at the 75–78% level. Genera placed close to *Ateuchotermes* in some eigenvectors of the principal co-ordinates analysis, as well as the cluster analyses, are *Alyscotermes*, *Anaorotermes*, *Acholotermes*. *Amicotermes* and *Aderitotermes*. Because the enteric valve of *Ateuchotermes* workers is so distinctive, there is no need to compare this caste to related genera. In the imago, *Alyscotermes* is distinguished by its rather regularly oval fontanelle; in *Ateuchotermes* this is never very clearly defined, and if nearly oval, is very small and indistinct. *Anaorotermes*, *Acholotermes* and *Amicotermes* have uneven pilosity, and the two latter genera, longer apical mandibular teeth. *Aderitotermes* has a sharply defined, pale coloured fontanelle. One species of *Ateuchotermes* keys out next to *Adynatotermes* but is smaller with larger eyes and ocelli and less inflated postclypeus. Certain species of *Astratotermes*, in particular *A. pacatus*, are very difficult to distinguish from one or two *Ateuchotermes* in which the fontanelle approaches oval shape. In *A. pacatus* the outline of the fontanelle has a tendency to be indistinct in some specimens, and there is no other character that can be used to separate it in the imago. Measurement characters provided no clear generic discrimination in either caste as shown by the canonical variates analyses in Text-figs 400 & 401.

Key to Species

Imagos

1 Compound eyes and ocelli large, W/E, 3·26–3·58, O_w/O–E, 2·27–5·60 (i.e. separated by less than half least diameter of ocellus) 2



FIGS 400 & 401. Three-dimensional graphs of canonical variates 1, 2 & 3 showing species of *Ateuchotermes* as solid spots. 400, imago; 401, worker caste.

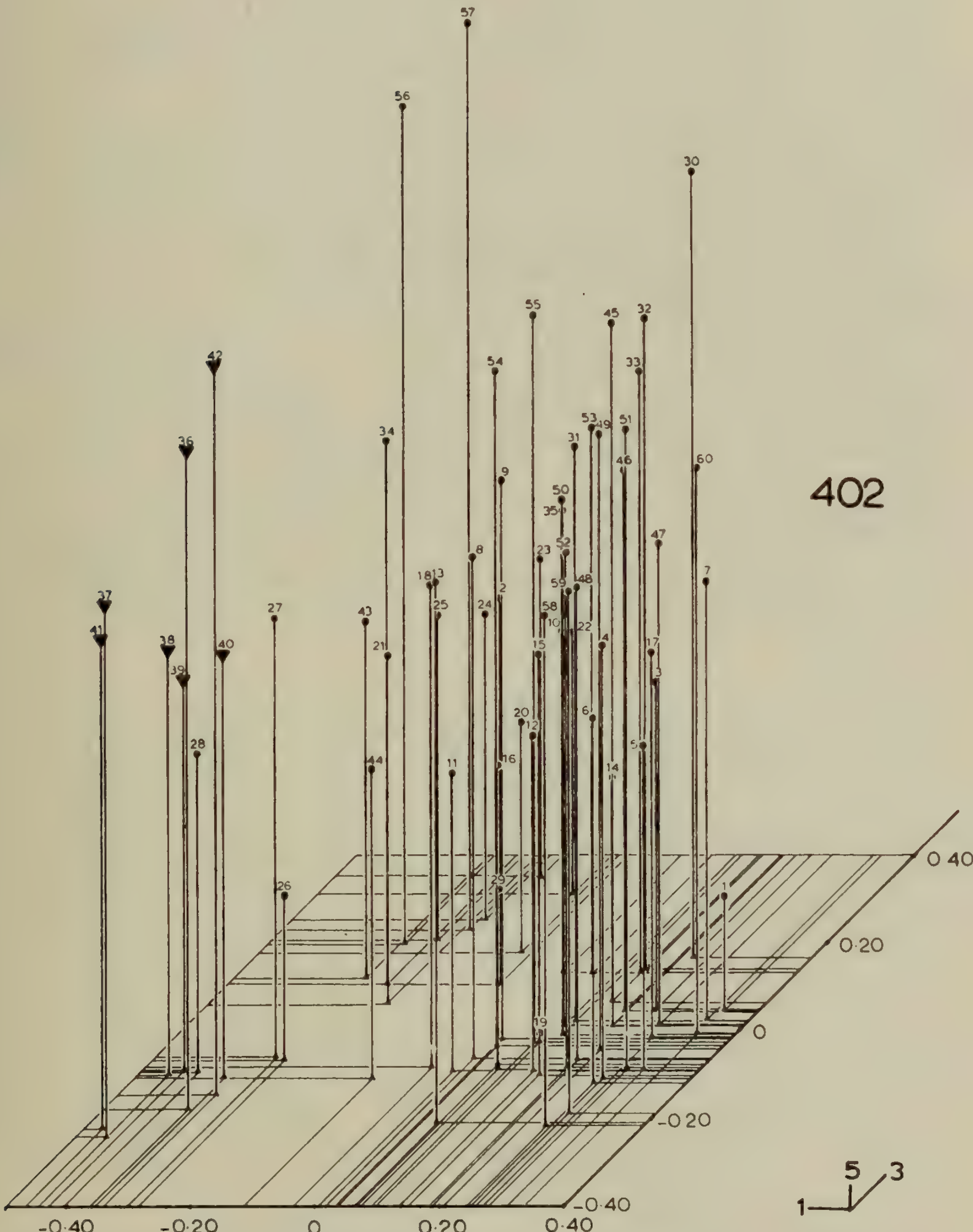


FIG. 402. Three-dimensional graph of principal co-ordinates analysis-plot of eigenvectors 1, 3 & 5 showing species of *Ateuchotermes* marked by large triangles.

– Compound eyes and ocelli smaller, W/E, 3·60–4·16, O_w/O–E, 0·71–1·80 (i.e. separated by more than half least diameter of ocellus) 3
2 Larger, W, 1·16–1·24. Postclypeus moderately inflated, Pcl/W, 0·27–0·28 ***rastratus*** (p. 171)
– Smaller, W, 0·98–1·04. Postclypeus scarcely inflated, Pcl/W, 0·23 ***retifaciens*** (p. 174)
3 Right mandible with anterior edge of first marginal tooth longer than that of second . 4
– Right mandible with anterior edge of first marginal tooth equal to or shorter than that of second 6
4 Postclypeus strongly inflated, Pcl/W, 0·29. Fore tibia with third apical spur vestigial, nearly obsolete. Ocellus separated from compound eye by distinctly more than own least diameter, O_w/O–E, 0·71 . . . . ***tranquillus*** (p. 181)
– Postclypeus less inflated, Pcl/W, 0·23–0·26. Fore tibia with third apical spur smaller but not vestigial. Ocellus separated from compound eye by less than own least diameter or slightly more, O_w/O–E, 0·90–1·31 5
5 Fontanelle short oval, coloured as head capsule. Pilosity of head capsule forming a somewhat rough pelt with uneven emergent setae. (Distribution, E. Africa) ***pectinatus*** (p. 168)
– Fontanelle irregularly rounded triangular, paler than head. Pilosity of head capsule forming a short, fine, even pelt with emergent setae. (Distribution, W. Africa) ***sentosus*** (p. 176)
6 Smaller, W, 0·90–1·01. Ocelli slightly closer to compound eyes, O_w/O–E, 1·19–1·80 ***ctenopher*** (p. 163)
– Larger, W, 1·10–1·23. Ocelli further from compound eyes, O_w/O–E, 0·82–1·13 . 7
7 Apical teeth of mandibles longer, L_A/L_1, 0·66, R_A/R_1, 1·01. Mesonotum narrower at constriction, M/W, 0·26. . . . . ***spinulatus*** (p. 179)
– Apical teeth of mandibles shorter, L_A/L_1, 0·50–0·60, R_A/R_1, 0·70–0·84. Mesonotum wider at constriction, M/W, 0·28–0·34 . . . . . ***muricatus*** (p. 165)

Workers

1 Enteric valve cushion in position 1 sclerotized only on distal half, only about one-quarter of total length of cushion protruding beyond tips of spines of other cushions; these spines stout and abruptly tapered at tips, not hooked (Pl. 4, fig. 5). Larger, W, 1·10. Enteric valve seating with distinct neck . . . ***tranquillus*** (p. 181)
– Enteric valve cushion in position 1 sclerotized throughout its length, of which about half protrudes beyond tips of spines of other cushions; these spines more slender, more finely tapered at tips, sometimes hooked. Smaller, W, 0·75–0·99. Enteric valve seating sessile or nearly so 2
2 Left mandible with proximal end of subsidiary marginal tooth level with edge of molar prominence in surface view. Enteric valve cushions in positions 2, 3 and 4 with extremely long fine slender spines, each with a completely recurved hook at the tip, capable of engagement with other spines to form a criss-crossed network (Pl. 6, figs 6–8) . . . . ***retifaciens*** (p. 174)
– Left mandible with proximal end of subsidiary marginal tooth clear of molar prominence in surface view. Enteric valve cushions in positions 2, 3 and 4 with shorter, less fine spines, if hooked, tips not fully recurved, incapable of engagement with other spines as above 3
3 Smaller, W, 0·75–0·85. Apical teeth of mandibles shorter, L_A/L_1, 0·45–0·58, R_A/R_1, 0·59–0·74. Fore tibia slightly thicker, T_1/T_w, 4·72–5·10 4
– Larger, W, 0·91–0·99. Apical teeth of mandibles longer, L_A/L_1, 0·64–0·74, R_A/R_1, 0·86–1·01. Fore tibia thinner in most species, T_1/T_w, 5·05–5·90 (only one under 5·20) 5
4 Postclypeus more inflated, Pcl/W, 0·26–0·28. Enteric valve cushion 1 with dilated outer end inflated in the middle and armed with two rows of prominent spines,

those of outer row numbering 30–40. Spines of other cushions slender, evenly tapered and nearly straight to their tips (Pl. 6, figs 1 & 2) . . ***ctenopher*** (p. 163)

– Postclypeus less inflated, Pcl/W, 0·22–0·24. Enteric valve cushion 1 with dilated outer end not inflated, flat in middle with a few scattered short spines and a single outer row of prominent spines numbering 14–18. Wall of enteric valve seating commonly with sclerotized cup which fits over spines of cushion 1. Spines of other cushions more tapered and slightly hooked at tips (Pl. 5, figs 7–9) ***sentosus*** (p. 176)

5 Right mandible with anterior edge of first marginal tooth equal to or longer than that of second. End of enteric valve cushion 1 armed with 15–23 spines (only one recorded over 20) 6

– Right mandible with anterior edge of first marginal tooth shorter than that of second. End of enteric valve cushion 1 armed with 23–40 spines (most specimens 25 or more) 7

6 Postclypeus more inflated, Pcl/W, 0·30. End of enteric valve cushion 1 more widely dilated (Pl. 5, figs 1–3) . . . . ***rastratus*** (p. 171)

– Postclypeus less inflated, Pcl/W, 0·27. End of enteric valve cushion 1 less widely dilated (Pl. 4, figs 6 & 7) . . . . ***pectinatus*** (p. 168)

7 Fore tibia slightly thicker, T_l/T_w, 5·05. Apical tooth of left mandible longer, $L_A/L_1.L_m$, 14·41 Mesenteric overlap with proctodeum at junction, length nearly three times width of mesenteron at insertion of malpighian tubules. Enteric valve cushions very narrow, positions 2–4 armed with long slender spines (Pl. 6, figs 3–5) . . . . ***spinulatus*** (p. 179)

– Fore tibia thinner, T_l/T_w, 5·35–5·90. Apical tooth of left mandible shorter, $L_A/L_1.L_m$, 10·28–13·06. Mesenteric overlap with proctodeum at junction about twice as long as width of mesenteron at insertion of malpighian tubules. Enteric valve cushions broader, positions 2–4 armed with stouter spines (Pl. 5, figs 4–6) ***muricatus*** (p. 165)

Ateuchotermes ctenopher sp. n.

(Text-figs 403, 404, 411, 412 & 419–444; Pl. 6, figs 1 & 2)

Imago. (Kings and Queens, colours may be faded.) Head capsule brown, sepia-brown above ocelli; fontanelle less than half size of ocellus, roughly circular, outline indistinct, flat or slightly depressed, pale yellow-brown; medial spot circular, flat or slightly raised, minute, coloured as head; postclypeus pale brown, labrum yellow; frontal marks very indistinct flat yellow-brown crescents; antennae pale yellow-brown. Pronotum, meso- and metanota pale brown, transverse dark sutures present; femora pale yellow-brown, tibiae paler, tarsi yellow-white. Abdominal tergites and dorsal stigmata pale yellow-brown, sternites and ventral stigmata very pale yellow-brown, sternites paler in middle, cerci yellow.

Posterior margin of head capsule not quite evenly rounded, slightly undulating, ocelli medium-sized, separated from compound eyes by from slightly over half to five-sixths own least diameter; postclypeus weakly to moderately inflated, Pcl/W, 0·23–0·26, posterior margin evenly rounded, median suture weakly developed. Apical teeth of mandibles short, L_A/L_1, 0·54–0·64, R_A/R_1, 0·69–0·84; subsidiary marginal tooth of left mandible with proximal end just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 7·40–9·10; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edge of first marginal distinctly shorter than that of second. Meso- and metanota moderately wide at constriction, M/W, 0·28–0·31. Pilosity of head capsule yellow-brown, very even pelt with very sparse emergent setae, mostly paired bilaterally.

Measurements (three specimens from two localities) in millimetres.

	Range	Mean
Head width across eyes (W)	0·90–1·01	0·938
Ocellus ($O_w \times O_l$)	0·08–0·09 × 0·10–0·13	0·084 × 0·118
Ocellus to eye (O–E)	0·05–0·07	0·061
Postclypeus length (Pcl)	0·21–0·25	0·231
Antennal article III	0·03–0·05	0·035
Antennal article IV	0·04–0·05	0·048
Antennal article V	0·04–0·05	0·046
Left mandible, apical to first marginal (L_A)	0·07–0·09	0·082
Left mandible, first to third marginal (L_l)	0·13–0·16	0·143
Left mandible, third marginal to molar (L_m)	0·07–0·08	0·070
Right mandible, apical to first marginal (R_A)	0·07–0·09	0·082
Right mandible, first to second marginal (R_l)	0·10–0·13	0·111
Right mandible, second marginal to molar (R_m)	0·07–0·08	0·072
Mesonotum width (M)	0·25–0·31	0·279
Metanotum width (N)	0·29–0·34	0·306

Worker. Head capsule pale yellow, pilosity yellow, sparse. Postclypeus moderately inflated, Pcl/W, 0·26–0·28. Apical teeth of mandibles short, L_A/L_l, 0·53–0·58, R_A/R_l, 0·71–0·74; subsidiary marginal tooth of left mandible with proximal end just clear of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 10·12–10·83; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal about half length of that of second, $R_A/R_l.R_m$, 12·13–13·80. Fore tibia scarcely swollen, T_l/T_w, 4·72–5·00, third apical spur nearly vestigial, about one-quarter length of other two. Mesenteric junction with proctodeum diagonal; enteric valve seating sessile on second pouch of proctodeum, very nearly dorsal in unopened abdomen; enteric valve cushion in position 1 sclerotized throughout its length, half of which protrudes beyond tips of spines of other positions, spines confined to dilated distal end, shaft smooth; spines on rim of dilated end 30–40 in number, middle portion of wider part inflated, with a second row of long spines, and scattered smaller spines behind them; cushions in other positions with 3–6 elongated curved spines, evenly tapered and almost straight at tips, few weakly hooked; membranous wall of valve beyond and between cushions without detectable spicules.

Measurements (two specimens from two localities) in millimetres.

Head width (W)	0·75–0·85
Fore tibia width (T_w)	0·11–0·12
Fore tibia length (T_l)	0·53–0·59
Postclypeus length (Pcl)	0·19–0·24
Left mandible, apical to first marginal (L_A)	0·07–0·08
Left mandible, first to third marginal (L_l)	0·13–0·14
Left mandible, third marginal to molar (L_m)	0·05–0·06
Right mandible, apical to first marginal (R_A)	0·07–0·08

Right mandible, first to second marginal (R_1)	0·10–0·11
Right mandible, second marginal to molar (R_m)	0·05–0·06

This is the smallest species of *Ateuchotermes*, although its known size range overlaps with *A. retifaciens*. The latter is distinguishable in the imago by its large ocelli, very close to the compound eyes, and in the worker caste by its very long hooked enteric valve spines on cushions 2, 3, 4, together with the different position of the subsidiary marginal tooth of the left mandible. The vestigial third spur on the fore tibia, the large size and differently proportioned marginal teeth of the right mandible distinguish the imago of *A. tranquillus*, the worker of which is also larger with a less well-developed enteric valve, particularly cushion position 1. All the other imagos are larger, *A. muricatus* having the ocelli further from the eyes; *A. pectinatus*, *A. rastratus* and *A. sentosus* all have the anterior edge of the right first marginal tooth longer than that of the second, and *A. spinulatus* has longer apical teeth and narrower meso- and metanota. In the worker caste, none of the remaining species has the middle part of the dilated distal end of enteric valve cushion 1 inflated, and armed with a second row of spines; they are all flat or concave with scattered spines. The condition of this structure seen in *A. ctenopher* and *A. retifaciens* would seem to represent the end point in specialization.

Holotype queen, paratype workers from type-colony, GABON: 18 km from Makokou, 8.iii.1962 (*J. Deligne*) in Musée Royal de l'Afrique Centrale, Tervuren. (Paratype king and workers from type-colony in BMNH.)

Other paratype material. DEMOCRATIC REPUBLIC OF CONGO: Kwango River, Takundi, 14.v.1964 (*G. Mathot*), queen and workers, in Musée Royal de l'Afrique Centrale, Tervuren.

Both nest-series were collected from beneath nests of other species, the type-colony beneath *Crenetermes albotarsalis* (Sjöstedt) and the other paratypes from a *Cubitermes* mound. The species is only known from the main Congo rain forest block, the two records being from localities just over 450 miles apart.

Ateuchotermes muricatus sp. n.

(Text-figs 405, 406, 413, 414 & 425–431; Pl. 5, figs 4–6)

Imago. Head capsule sepia-brown, darker above ocelli and around compound eyes; fontanelle oval or circular, smaller than ocellus, margins indistinct, sometimes approaching triangular, flat or slightly depressed, brown or paler to near yellow-white; medial spot circular, flat, smaller than fontanelle, slightly paler than head; postclypeus sepia-brown, labrum brown; frontal marks distinct, flat, semicircular, coloured as head; antennae pale brown. Pronotum, meso- and metanota sepia-brown, transverse dark sutures weakly developed, particularly on mesonotum; femora and tibiae pale brown, tarsi yellow. Abdominal tergites and sternites brown, the latter paler in middle, dorsal and ventral stigmata both darker, sepia-brown; cerci pale yellow-brown.

Posterior margin of head capsule not evenly rounded, distinctly undulating; ocelli rather small, separated from compound eyes by slightly less to rather more than own least diameter;

postclypeus moderately to strongly inflated, Pcl/W, 0·28–0·34, posterior margin evenly rounded, median suture weakly developed or near absent. Apical teeth of mandibles short, L_A/L_1, 0·50–0·60, R_A/R_1, 0·70–0·84; subsidiary marginal tooth of left mandible well clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 5·33–7·72; points of apical and marginal teeth of right mandible almost in line, anterior edges of first and second marginals about equal in length. Meso- and metanota moderately wide at constriction, M/W, 0·28–0·34. Pilosity of head brown, pelt with uneven emergent setae.

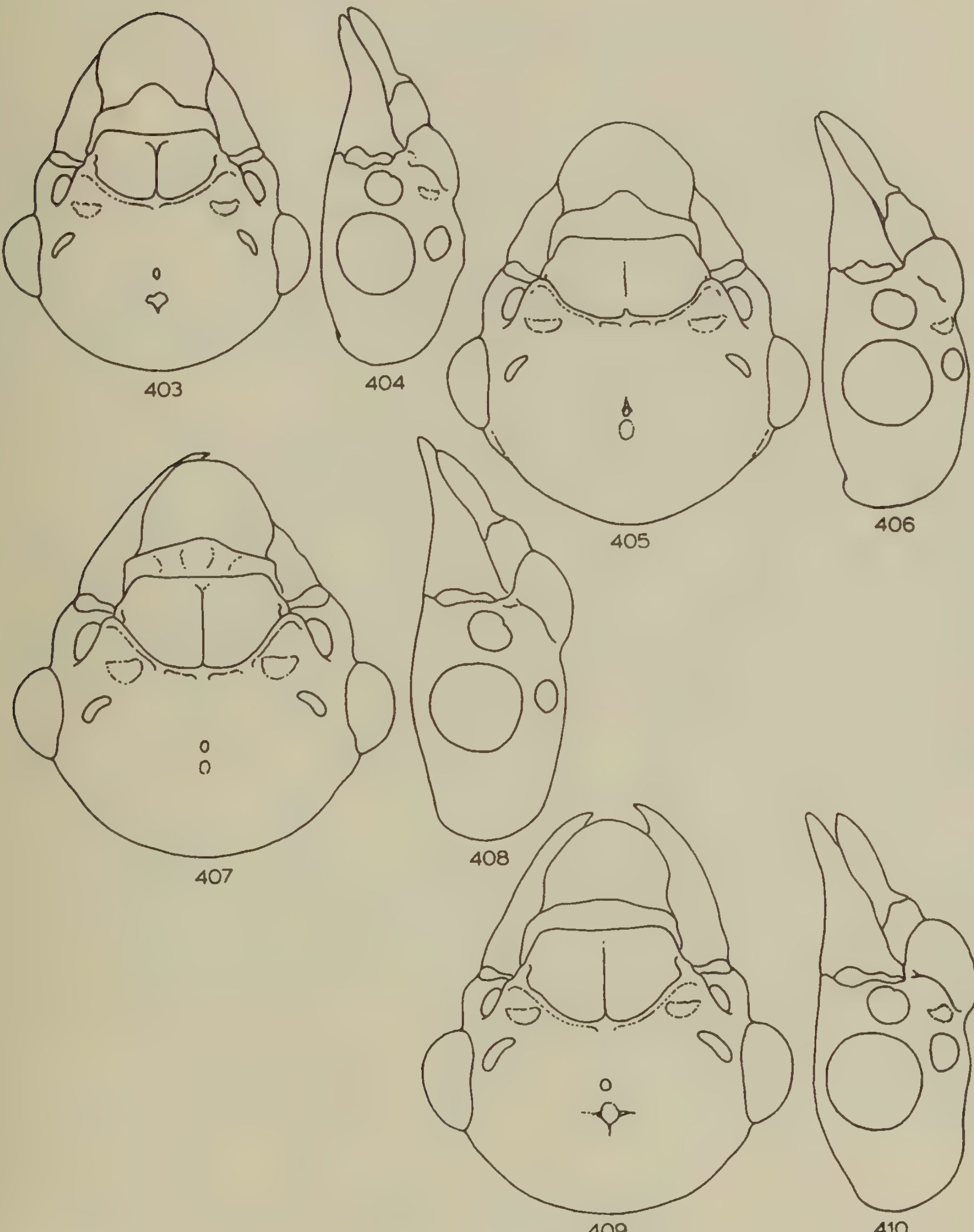
Measurements (six specimens from six localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	1·10–1·23	1·161 ± 0·049
Ocellus ($O_w \times O_l$)	0·07–0·09 × 0·09–0·13	0·077 ± 0·006 × 0·111 ± 0·007
Ocellus to eye (O–E)	0·07–0·09	0·080 ± 0·007
Postclypeus length (Pcl)	0·24–0·27	0·254 ± 0·015
Antennal article III	0·03–0·05	0·043 ± 0·006
Antennal article IV	0·05–0·06	0·058 ± 0·005
Antennal article V	0·06–0·08	0·064 ± 0·006
Left mandible, apical to first marginal (L_A)	0·08–0·11	0·094 ± 0·007
Left mandible, first to third marginal (L_1)	0·16–0·19	0·174 ± 0·010
Left mandible, third marginal to molar (L_m)	0·08–0·09	0·084 ± 0·006
Right mandible, apical to first marginal (R_A)	0·09–0·10	0·095 ± 0·005
Right mandible, first to second marginal (R_1)	0·12–0·14	0·128 ± 0·007
Right mandible, second marginal to molar (R_m)	0·08–0·09	0·083 ± 0·005
Mesonotum width (M)	0·31–0·40	0·360 ± 0·029
Metanotum width (N)	0·34–0·40	0·375 ± 0·017

Worker. Head capsule pale yellow, pilosity yellow, sparse. Postclypeus weakly to moderately inflated, Pcl/W, 0·24–0·28. Apical teeth of mandibles fairly short, or a little longer, L_A/L_1, 0·64–0·73, R_A/R_1, 0·86–0·93; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio, $L_A/L_1.L_m$, 10·28–13·06; point of first marginal tooth of left mandible slightly behind line of apical to second marginal, anterior edges of first and second marginals approximately equal, or first slightly shorter, $R_A/R_1.R_m$, 13·68–17·10. Fore tibia slender, T_l/T_w, 5·35–5·90, third apical spur minute, vestigial, even absent in some specimens though seldom in all of one nest-series. Mesenteric junction with proctodeum slightly longer than diagonal; enteric valve seating with very short neck, nearly dorsal in unopened abdomen; enteric valve cushion in position 1 sclerotized throughout its length of which about half protrudes beyond tips of spines of other positions, dilated end ringed with 23–38 (average 29·4) elongated spines, shaft and concave surface of dilated end with scattered small spines, base of shaft wrinkled transversely; cushions in other positions with 1–10 (average 5·1) elongated curved spines, weakly hooked at tips, and smaller spines on remainder of length; membranous wall of valve between and beyond cushions without detectable spicules.

Measurements (five specimens from five localities) in millimetres.

	Range	Mean ± S.D.
Head width (W)	0·91–0·98	0·948 ± 0·029
Fore tibia width (T_w)	0·12–0·13	0·122 ± 0·003
Fore tibia length (T_l)	0·66–0·74	0·695 ± 0·039



FIGS 403–410. *Ateuchotermes*, imago head capsules, front and side views. 403, 404, *A. ctenopher*; 405, 406, *A. muricatus*; 407, 408, *A. pectinatus*; 409, 410, *A. rastratus*.

Postclypeus length (Pcl)	0·22–0·26	0·244 ± 0·017
Left mandible, apical to first marginal (L_A)	0·09–0·10	0·095 ± 0·007
Left mandible, first to third marginal (L_l) .	0·13–0·15	0·141 ± 0·008
Left mandible, third marginal to molar (L_m)	0·05–0·06	0·056 ± 0·006
Right mandible, apical to first marginal (R_A)	0·08–0·10	0·093 ± 0·008
Right mandible, first to second marginal (R_l)	0·09–0·11	0·105 ± 0·009
Right mandible, second marginal to molar (R_m)	0·05–0·06	0·058 ± 0·005

A. muricatus has already been compared with *A. ctenopher* under the latter heading. *A. retifaciens* is distinguished by the same characters that separate it from *A. ctenopher*, as also is *A. tranquillus*. The differing mandible proportions again characterize the remaining species in the imago. In the worker caste *A. sentosus* is smaller, and the wall of the enteric valve seating bears a sclerotized cup that receives the dilated end of cushion 1. *A. rastratus* and *A. pectinatus* have the outer edge of the right first marginal tooth longer than the second, and *A. spinulatus* has longer apical teeth, and slender spines on the enteric valve cushions in positions 2–4. The enteric valve of *A. muricatus* seems intermediate in development between the forms seen in *A. rastratus* and *A. pectinatus*, and the 'slender' form of *A. spinulatus*. It shows a fair amount of variation between specimens from Malawi and South Africa, and there is a possibility that two species have been combined here. However, separation would not seem to be justified at present without more material and information since there are intermediate specimens.

Holotype ♀ winged imago, and three paratype workers from type-colony, REPUBLIC OF SOUTH AFRICA: Transvaal, Sibasa, 9.vii.1960 (*J. L. Sheasby*) in National Collection of Isoptera, Coll. No. TM 7413, Pretoria.

Other paratype material. REPUBLIC OF SOUTH AFRICA: Transvaal, Carolina, 22.xii.1955 (*W. G. H. Coaton*); Ermelo, 6.vi.1956 (*J. H. Grobler*); Carolina, 26.x.1960 (*J. L. Sheasby*), alates and workers. SWAZILAND: Mbabane, 23.x.1960 (*W. G. H. Coaton*) alates and workers, all above in N.C.I., Pretoria. MALAWI: Vipya Plateau, 6 m. N. of Mount Chioli (two vials) 20.ix.1953, king and workers, 7 m. from Kota-Kota on Kasungu Road, 17.ix, 33 m. from Kasungu on Lilongwe Road, 18.ix, Nyika Plateau (two vials) 29.ix, and Songwe, 1.x.1953, all workers only (*W. A. Sands & W. Wilkinson*), all in BMNH.

Most of the records are from the low mounds of *Cubitermes* spp., only one series being found under dead wood in an area of tall dense woodland approaching rain forest conditions.

Ateuchotermes pectinatus sp. n.

(Text-figs 407, 408, 415, 416 & 432–438; Pl. 4, figs 6 & 7)

Imago. Head capsule dark chestnut-brown, not darker above ocelli; fontanelle much smaller than ocellus, circular to short oval indistinct outline, flat or slightly depressed, coloured as head; medial spot circular or broad oval, flat or slightly raised, equal in size to fontanelle or slightly

larger, coloured as head; postclypeus chestnut-brown, labrum yellow-brown; frontal marks distinct, semicircular, flat or slightly depressed, brown; antennae brown. Pronotum, meso- and metanota chestnut-brown, transverse dark sutures weak on mesonotum, present on metanotum; femora and tibiae brown, tarsi yellow. Abdominal tergites brown, dorsal stigmata dark sepia-brown, sternites pale brown, yellow-brown in middle, ventral stigmata sepia-brown; cerci pale yellow-brown.

Posterior margin of head capsule not quite evenly rounded, slightly undulating; ocelli proportionately rather small, separated from compound eyes by about three-quarters, up to slightly more than own least diameter; postclypeus weakly to moderately inflated, Pcl/W, 0·23–0·26, posterior margin bowed, not evenly rounded, median suture distinct. Apical teeth of mandibles short, L_A/L_1, 0·54–0·60, R_A/R_1, 0·73–0·89; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio, $L_A/L_1.L_m$, 5·90–7·84; points of apical and marginal teeth of right mandible in line, anterior edge of first marginal longer than that of second. Meso- and metanota fairly wide at constriction, M/W, 0·29–0·33. Pilosity of head capsule yellow-brown, pelt somewhat rough, slightly uneven.

FIGS 411–418. *Ateuchotermes*, imago mandibles. 411, 412, *A. ctenopher*; 413, 414, *A. muricatus*; 415, 416, *A. pectinatus*; 417, 418, *A. rastratus*.

Measurements (seven specimens from four localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W) .	1·04–1·30	1·177 ± 0·089
Ocellus ($O_w \times O_l$) . . .	0·08–0·13 × 0·11–0·15	0·092 ± 0·020 × 0·131 ± 0·016
Ocellus to eye (O–E) . .	0·08–0·10	0·087 ± 0·007
Postclyepeus length (Pcl) .	0·24–0·31	0·285 ± 0·022
Antennal article III . .	0·03–0·08	0·045 ± 0·017
Antennal article IV . .	0·06–0·09	0·066 ± 0·012
Antennal article V . . .	0·05–0·08	0·064 ± 0·011
Left mandible, apical to first marginal (L_A) . . .	0·09–0·10	0·096 ± 0·004
Left mandible, first to third marginal (L_l) . . .	0·16–0·19	0·173 ± 0·010
Left mandible, third marginal to molar (L_m) . . .	0·08–0·09	0·085 ± 0·006
Right mandible, apical to first marginal (R_A) . . .	0·09–0·11	0·100 ± 0·005
Right mandible, first to second marginal (R_l) . . .	0·11–0·14	0·124 ± 0·011
Right mandible, second marginal to molar (R_m) . .	0·08–0·10	0·087 ± 0·007
Mesonotum width (M) . .	0·33–0·41	0·366 ± 0·038
Metanotum width (N) . .	0·33–0·43	0·380 ± 0·036

Worker. Head capsule and pilosity pale yellow, setae sparsely scattered. Postclypeus moderately inflated, Pcl/W, 0·27. Apical teeth of mandibles fairly long, L_A/L_l, 0·70–0·71, R_A/R_l, 1·00–1·01; subsidiary marginal tooth of left mandible separated from molar prominence by deep notch in surface view, complex ratio $L_A/L_l.L_m$, 8·90–11·09; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edges of first and second marginals equal, $R_A/R_l.R_m$, 14·99–15·05. Fore tibia slender, T_l/T_w, 5·29–5·64, third apical spur vestigial, even absent in some specimens, rarely in all of any nest series. Mesenteric junction with proctodeum diagonal; enteric valve seating connected to second pouch of proctodeum by very short neck, dorsolateral in unopened abdomen; enteric valve cushion in position 1 sclerotized throughout its length, half of which protrudes beyond tips of spines of other positions, dilated end fringed with 15–18 (average 16·3) elongated spines, shaft and concave surface of dilated end with scattered small spines, base of shaft weakly wrinkled transversely; cushions in other positions with 3–5 (average 3·5) elongated curved spines, sharply tapered and weakly hooked at tips, and smaller spines on remainder of length. Membranous wall of valve beyond and between cushions with definite spicules fringing small lobes.

Measurements (three specimens from three localities) in millimetres.

	Range	Mean
Head width (W)	0·94–0·99	0·967
Fore tibia width (T_w)	—	0·127
Fore tibia length (T_l)	0·69–0·71	0·700
Postclypeus length (Pcl)	0·25–0·27	0·260
Left mandible, apical to first marginal (L_A) . .	0·10–0·11	0·105
Left mandible, first to third marginal (L_l) . .	0·14–0·15	0·148
Left mandible, third marginal to molar (L_m) . .	0·06–0·08	0·071
Right mandible, apical to first marginal (R_A) . .	0·10–0·11	0·107
Right mandible, first to second marginal (R_l) . .	0·10–0·11	0·106
Right mandible, second marginal to molar (R_m) .	0·07–0·08	0·070

Comparisons have already been made between *A. pectinatus*, *A. ctenopher* and *A. muricatus*. In the imago caste, *A. rastratus* and *A. retifaciens* have larger eyes and ocelli closer together, than in *A. pectinatus*. The reverse is true of *A. tranquillus*, which also has a more inflated postclypeus and vestigial third apical spur on the fore tibia. *A. sentosus* has more even head pilosity, and a differently shaped fontanelle. *A. spinulatus* has longer apical mandibular teeth, and narrower meso- and metanota. In the worker caste, *A. rastratus* is difficult to distinguish from *A. pectinatus*, having a slightly more inflated postclypeus and possibly a somewhat wider dilation at the end of enteric valve cushion 1, though this may not be constant. The sclerotized cup and fenestrated base of enteric valve cushion 1 distinguish *A. sentosus*, as well as its smaller size. The longer apical teeth of the mandibles and slender spines on enteric valve cushions 2, 3 and 4 distinguish *A. spinulatus*, also the more numerous spines fringing cushion 1. In *A. tranquillus* the enteric valve armature is less well developed, position 1 being only partly sclerotized and shorter. In *A. retifaciens* it reaches the other extreme with elongated hooked spines in positions 2, 3 and 4.

Holotype ♀ imago, paratype ♂ and ♀ imagos and workers from type-colony, KENYA: Kaptagat Forest, alt. 8,000 ft, 2.iv.1952 (*W. V. Harris* Coll. No. 826) in British Museum (Natural History).

Other paratype material. KENYA: Kaptagat, 3.iv.1952 (*W. A. Sands*); Londiani, alt. 8,100 ft, 18.ii.1954 (*R. M. C. Williams*). UGANDA: Ruwenzori, Fort Portal, 1952 (*H. A. Osmaston*), alates and workers, all above in BMNH. DEMOCRATIC REPUBLIC OF CONGO: Kivu, Lwiro (two vials), 24, 5.x, Irangi, 1°53′S., 28°28′E., 10.xi.1963 (*E. Ernst*), workers only, in BMNH and Swiss Tropical Institute, Basle.

All the biological information on this species points to its being an inhabitant of the mounds of other species, either *Cubitermes* or *Odontotermes*, at considerable altitudes.

Ateuchotermes rastratus sp. n.

(Text-figs 409, 410, 417, 418 & 439–444; Pl. 5, figs 1–3)

Imago. Head capsule chestnut-brown, darker above ocelli; fontanelle roughly circular, slightly depressed, much smaller than ocellus, pale yellow-brown; medial spot circular, flat, smaller than fontanelle, coloured as head; postclypeus paler than head, ferruginous chestnut-brown, labrum yellow-brown; frontal marks, very indistinct flat crescents, coloured as post-clypeus; antennae yellow. Pronotum, meso- and metanota brown, transverse sutures virtually absent; femora pale yellow-brown, tibiae and tarsi yellow. Abdominal tergites brown, dorsal stigmata yellow-brown, sternites yellow-brown with middle and ventral stigmata paler; cerci yellow.

Posterior margin of head capsule slightly undulating, not quite evenly rounded; ocelli proportionately fairly large, separated from large compound eyes by less than half own least diameter; postclypeus moderately inflated, Pcl/W, 0·27–0·28, posterior margin bowed, not evenly rounded, median suture distinct. Apical teeth of mandibles short, L_A/L_1, 0·56–0·62, R_A/R_1, 0·80–0·92; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio, $L_A/L_1.L_m$, 6·88–8·20; points of apical and marginal teeth of right mandible in line, anterior edge of first marginal longer than that of second. Meso- and metanota fairly wide at constriction, M/W, 0·30. Pilosity of head capsule yellow-brown, rather long, forming slightly uneven pelt.

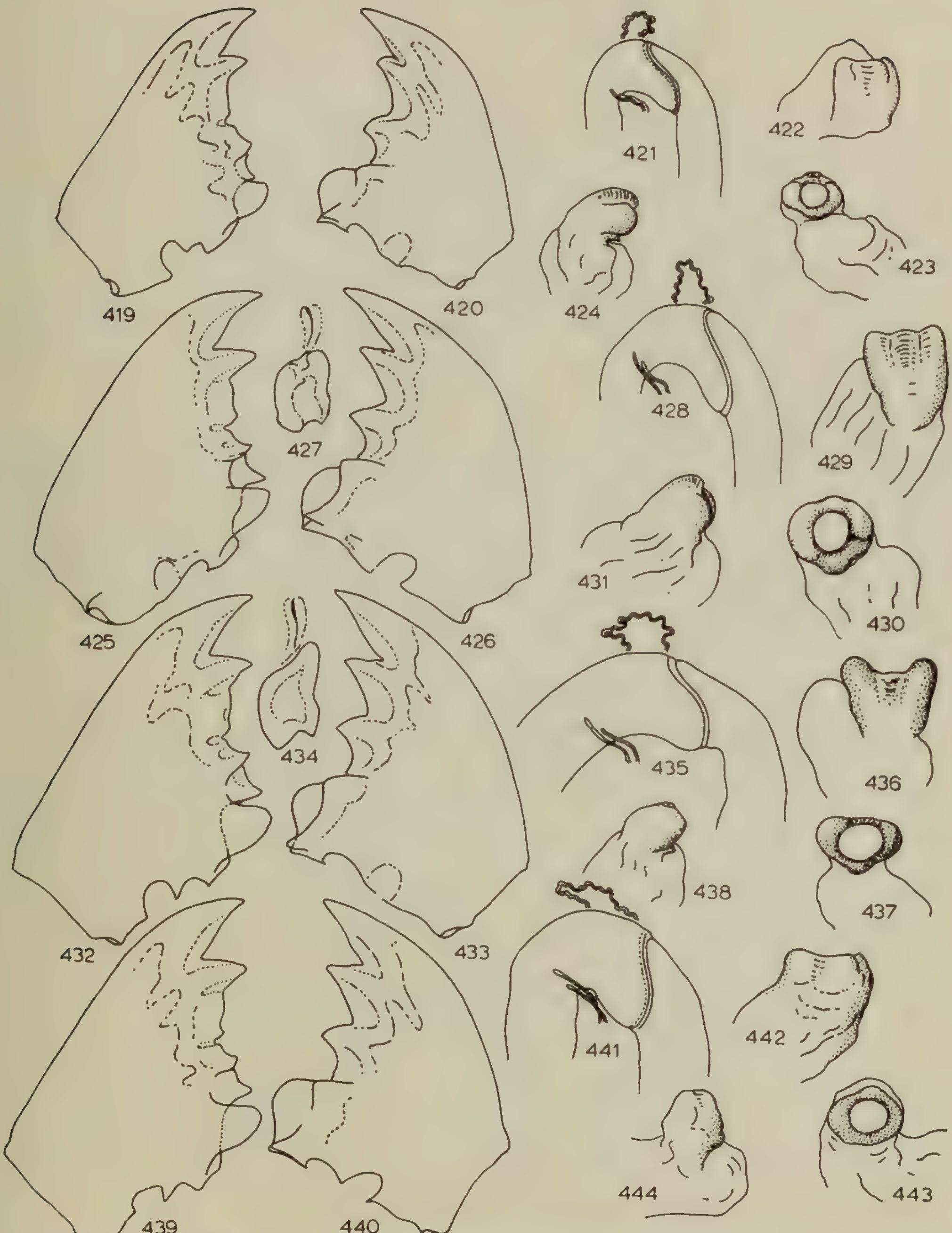
Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W)	1·16–1·24
Ocellus ($O_w \times O_l$)	0·11–0·12 × 0·15
Ocellus to eye (O–E)	0·03–0·05
Postclypeus length (Pcl)	0·31–0·34
Antennal article III	0·04–0·05
Antennal article IV	0·05–0·06
Antennal article V	0·05–0·06
Left mandible, apical to first marginal (L_A)	0·10
Left mandible, first to third marginal (L_l)	0·16–0·18
Left mandible, third marginal to molar (L_m)	0·08–0·09
Right mandible, apical to first marginal (R_A)	0·10
Right mandible, first to second marginal (R_l)	0·11–0·13
Right mandible, second marginal to molar (R_m)	0·08–0·09
Mesonotum width (M)	0·35–0·37
Metanotum width (N)	0·38

Worker. Head capsule pale yellow, pilosity yellow, sparsely scattered. Postclypeus moderately inflated, Pcl/W, 0·30. Apical teeth of mandibles fairly long, L_A/L_l, 0·72–0·74, R_A/R_l, 0·96; subsidiary marginal tooth of left mandible separated from molar prominence by deep notch in surface view, complex ratio, $L_A/L_l.L_m$, 11·19–11·50; points of apical and marginal teeth of right mandible very nearly in line, anterior edge of first marginal slightly longer than that of second, equal if worn, $R_A/R_l.R_m$, 13·52–15·27. Fore tibia slender, T_l/T_w, 5·20–5·64, third apical spur smaller than other two, vestigial or up to nearly half their length. Mesenteric junction with proctodeum diagonal; enteric valve seating practically sessile on second pouch of proctodeum, dorsolateral in unopened abdomen; enteric valve cushion in position 1 sclerotized throughout its length, half of which protrudes beyond tips of spines of other positions, dilated and fringed with 15–23 (average 18·5) spines, shaft and concave surface of dilated end with scattered small spines, base of shaft distinctly transversely wrinkled; cushions in other positions with 2–7 (average 4·3) elongated curved spines, sharply tapered and distinctly hooked at tips, and smaller spines on remainder of length. Membranous wall of valve beyond and between cushions with definite spicules fringing small lobes.

Measurements (two specimens from one locality) in millimetres.

Head width (W)	0·91–0·98
Fore tibia width (T_w)	0·13
Fore tibia length (T_l)	0·65–0·72
Postclypeus length (Pcl)	0·27–0·29
Left mandible, apical to first marginal (L_A)	0·11
Left mandible, first to third marginal (L_l)	0·15
Left mandible, third marginal to molar (L_m)	0·06–0·07
Right mandible, apical to first marginal (R_A)	0·11



FIGS 419–444. *Ateuchotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and position of malpighian knot, and views of enteric valve seatings. 419–424, *A. ctenopher*; 425–431, *A. muricatus*; 432–438, *A. pectinatus*; 439–444, *A. rastratus*. (427 & 434 show right molar plate in surface view.)

Right mandible, first to second marginal (R_1)	0·11
Right mandible, second marginal to molar (R_m)	0·06–0·07

A. rastratus is compared with *A. ctenopher*, *A. muricatus* and *A. pectinatus* under those species. In the imago caste, it differs from all the remaining species other than *A. retifaciens* in having rather large eyes and ocelli, close together. The latter species is smaller, with a feebly inflated postclypeus, and the ocelli even closer to the eyes. In the worker, *A. retifaciens* has two rows of spines on the dilated end of enteric valve cushion 1, and long, slender, hooked spines on positions 2, 3 and 4. *A. sentosus* is again recognizable by the fenestrated base and sclerotized cup of position 1, *A. spinulatus* by the more numerous spines on position 1 and the slender spines in the other positions, and *A. tranquillus* by the incomplete sclerotization of the shorter cushion position 1.

Holotype ♀ imago, paratype ♂ and ♀ imagos and workers from type-colony, KENYA: Nyambeni Hills, 22 m. from Meru, alt. 4,000 ft, 21.ii.1953 (*W. A. Sands*, Coll. No. S409) in British Museum (Natural History).

Other paratype material. TANZANIA: Amani, Kizugu, 3.xi.1950, queen and workers, Amani, Monga Road, 2.iii.1951 (*P. B. Kemp*), workers only, in BMNH.

This species was found in low amorphous mounds apparently of its own construction, and under dead wood.

Ateuchotermes retifaciens sp. n.

(Text-figs 445–447, 454, 455 & 462–467; Pl. 6, figs 6–8)

Imago. Head capsule brown, not darker above ocelli; fontanelle irregularly oval, almost vestigial, much smaller than ocellus, flat or slightly depressed, pale or yellow-brown; medial spot oval, flat, nearly equal in size to fontanelle, slightly paler than head; postclypeus pale yellow-brown, labrum pale yellow; frontal marks pale yellow-brown, flat crescents; antennae yellow. Pronotum pale brown, meso- and metanota pale yellow-brown, transverse sutures virtually absent; femora pale yellow, tibiae and tarsi yellow-white. Abdominal tergites and dorsal stigmata pale brown, sternites and ventral stigmata very pale brown, middles of sternites and cerci pale yellow.

Posterior margin of head capsule evenly rounded; ocelli and compound eyes both large, and almost touching, maximum separation less than a quarter own least diameter; postclypeus weakly inflated, Pcl/W, 0·23, posterior margin evenly rounded, median suture present in ♀, weak in ♂. Apical teeth of mandibles short, L_A/L_1, 0·53–0·55, R_A/R_1, 0·75–0·77; subsidiary marginal tooth of left mandible distinctly clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 6·10–6·87; points of apical and marginal teeth of right mandible in line, anterior edge of first marginal longer than that of second. Meso- and metanota moderately wide at constriction, M/W, 0·29–0·33. Pilosity of head capsule very pale brown, an even pelt with scattered emergent setae.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W) .	0·98–1·04
Ocellus ($O_w \times O_l$) . . .	0·11–0·12 × 0·13–0·14
Ocellus to eye (O–E) . .	0·02–0·03
Postclypeus length (Pcl) . .	0·23–0·24

Antennal article III	0·04–0·05
Antennal article IV	0·06
Antennal article V	0·06
Left mandible, apical to first marginal (L_A)	0·08
Left mandible, first to third marginal (L_l)	0·14
Left mandible, third marginal to molar (L_m)	0·08–0·09
Right mandible, apical to first marginal (R_A)	0·08–0·09
Right mandible, first to second marginal (R_l)	0·11
Right mandible, second marginal to molar (R_m)	0·08
Mesonotum width (M)	0·29–0·34
Metanotum width (N)	0·30–0·36

Worker. Head capsule pale yellow, pilosity yellow, sparse. Postclypeus moderately inflated, Pcl/W, 0·27. Apical teeth of mandibles short, L_A/L_l, 0·53, R_A/R_l, 0·68; subsidiary marginal tooth of left mandible with proximal end just level with edge of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 8·40; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal shorter than that of second, $R_A/R_l.R_m$, 10·40. Fore tibia scarcely swollen, T_l/T_w, 5·10, third apical spur about one-third length of other two. Mesenteric junction with proctodeum diagonal; enteric valve seating with short neck, dorsolateral in unopened abdomen; enteric valve cushion in position 1 sclerotized throughout its length, half of which protrudes beyond tips of spines of other positions, spines confined to dilated distal end, shaft smooth; spines on rim of dilated end 30–40, in number, middle portion of wider part inflated with a second row of long spines, and scattered long and smaller spines behind them; cushions in other positions with 7–10 extremely elongated straight slender spines, each tipped with a completely recurved hook, capable of engaging upon spines of other positions to form a criss-cross network; membranous wall of valve between and beyond cushions without detectable spicules.

Measurements (one specimen) in millimetres.

Head width (W)	0·96
Fore tibia width (T_w)	0·14
Fore tibia length (T_l)	0·70
Postclypeus length (Pcl)	0·26
Left mandible, apical to first marginal (L_A)	0·08
Left mandible, first to third marginal (L_l)	0·15
Left mandible, third marginal to molar (L_m)	0·06
Right mandible, apical to first marginal (R_A)	0·09
Right mandible, first to second marginal (R_l)	0·13
Right mandible, second marginal to molar (R_m)	0·06

Comparisons have already been made between *A. retifaciens* and the preceding species, *A. ctenopher*, *A. muricatus*, *A. pectinatus* and *A. rastratus*. It is a distinctive species in the imago in having such large eyes and ocelli; and in this it differs from

the remaining three species, *A. sentosus*, *A. spinulatus* and *A. tranquillus*. The enteric valve armature of the worker caste, with its extremely long hooked spines, also serves to distinguish it clearly from these species. Even *A. spinulatus*, which has thin elongated spines, cannot be confused in this respect, especially since it also has longer apical mandibular teeth, and the subsidiary marginal tooth of the left mandible clear of the molar prominence.

Holotype queen, and paratype workers from type-colony, DEMOCRATIC REPUBLIC OF CONGO: Kivu, Irangi, 1°53′S., 28°28′E., 9.xi.1963 (*E. Ernst*), in British Museum (Natural History); paratype king and workers from type-colony, in Swiss Tropical Institute, Basle.

The smaller nest-chambers of this species were found beneath a typical mound of *Thoracotermes macrothorax* (Sjöstedt) against a tree in rain forest.

Ateuchotermes sentosus sp. n.

(Text-figs 448, 449, 456, 457 & 468–473; Pl. 5, figs 7–9)

Imago. Head capsule sepia-brown, not darker above ocelli; fontanelle about half size of ocellus, irregular short oval, flat, brown; medial spot short oval, flat, smaller than fontanelle, coloured as head; postclypeus brown, labrum yellow-brown; frontal marks smooth flat crescents, coloured as postclypeus; antennae pale yellow-brown. Pronotum brown, meso- and metanota yellow-brown, transverse dark sutures weakly developed; femora yellow, tibiae paler, tarsi yellow-white. Abdominal tergites and dorsal stigmata yellow-brown, sternites paler, ventral stigmata paler than sternites; cerci yellow.

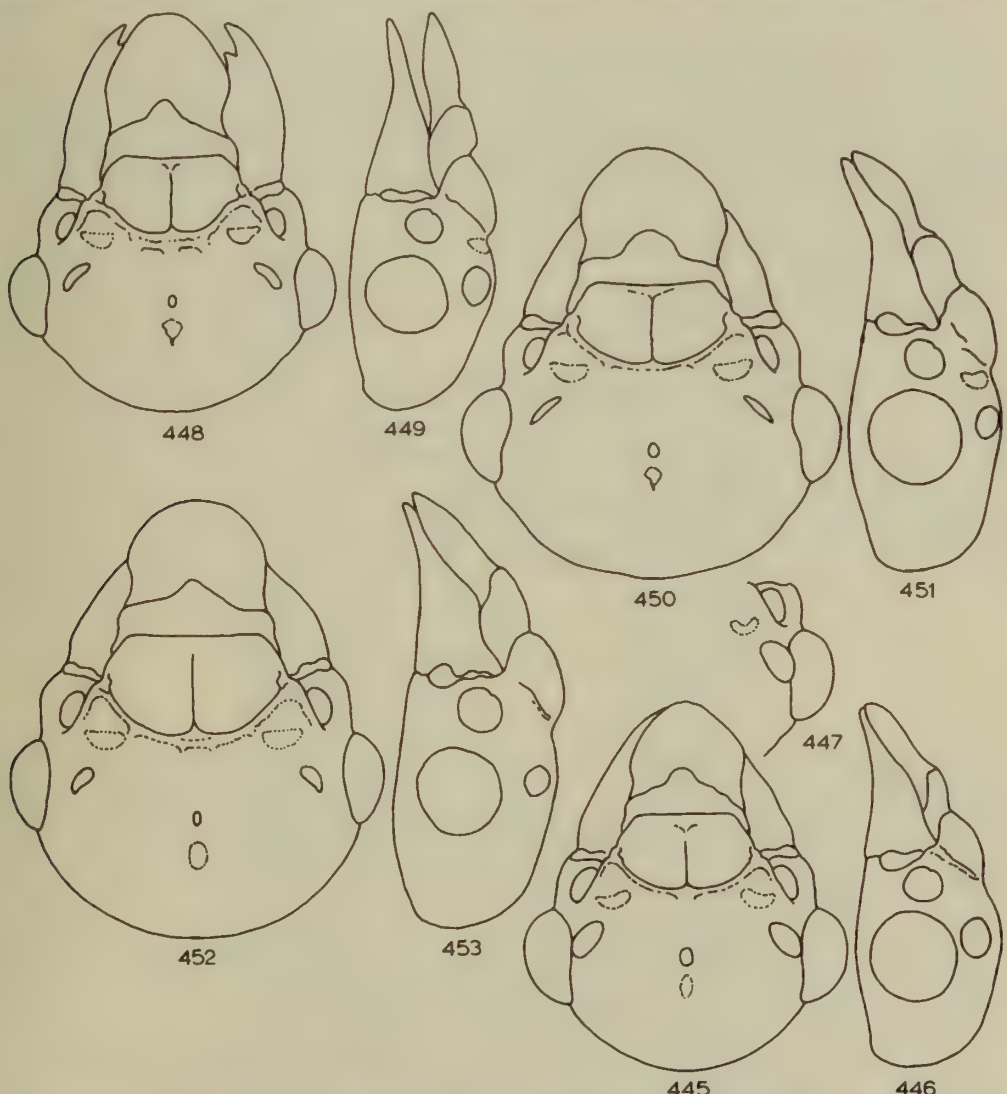
Posterior margin of head capsule slightly undulating, not evenly rounded; ocelli fairly large, separated from compound eyes by about three-quarters own least diameter; postclypeus weakly inflated, Pcl/W, 0·25, posterior margin somewhat indistinct, bowed, not evenly rounded, median suture distinct. Apical teeth of mandibles short, L_A/L_1, 0·54, R_A/R_1, 0·83; subsidiary marginal tooth of left mandible with proximal end just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 6·45; points of apical and marginal teeth of right mandible in line, anterior edge of first marginal longer than that of second. Meso- and metanota fairly wide at constriction. M/W, 0·33. Pilosity of head capsule a fine close even pelt with emergent setae.

Measurements (one specimen) in millimetres.

Head width across eyes (W)	1·04
Ocellus ($O_w \times O_l$)	0·09 × 0·13
Ocellus to eye (O–E)	0·07
Postclypeus length (Pcl)	0·26
Antennal article III	0·04
Antennal article IV	0·06
Antennal article V	0·06
Left mandible, apical to first marginal (L_A)	0·09
Left mandible, first to third marginal (L_1)	0·17
Left mandible, third marginal to molar (L_m)	0·08
Right mandible, apical to first marginal (R_A)	0·10

Right mandible, first to second marginal (R_1)	0·12
Right mandible, second marginal to molar (R_m)	0·09
Mesonotum width (M)	0·34
Metanotum width (N)	0·38

Worker. Head capsule and pilosity pale yellow, setae sparse. Postclypeus weakly inflated, Pcl/W, 0·22–0·24. Apical teeth of mandibles short, L_A/L_1, 0·45–0·48. R_A/R_1, 0·59–0·65;



FIGS 445–453. *Ateuchotermes*, imago head capsules, front and side views. 445–447, *A. retifaciens*, 447 shows compound eye and ocellus of ♂; 448, 449, *A. sentosus* ♂; 450, 451, *A. spinulatus*; 452, 453, *A. tranquillus*.

subsidiary marginal tooth of left mandible with proximal end just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 8·32–8·45; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal about half length of second, $R_A/R_1.R_m$, 10·91–11·52. Fore tibia scarcely swollen, T_l/T_w, 4·80–5·10, third apical spur vestigial, up to one-quarter length of other two. Mesenteric junction with proctodeum slightly longer than diagonal; enteric valve seating virtually sessile on second pouch of proctodeum, dorsolateral to nearly dorsal in unopened abdomen; enteric valve cushion in position 1 sclerotized throughout its length, half of which protrudes beyond tips of spines of other positions, spines confined to proximal and distal ends, shaft smooth; spines on rim of dilated distal end 14–20 in number, middle part of dilation rounded with scattered fairly long spines, base of shaft fenestrated with a minute spine in each 'hole'; wall of enteric valve seating adjacent to dilated end of position 1, indented and sclerotized in the form of a rounded cup, into which the spines of position 1 fit neatly; this cup sclerotization purplish-brown when fully developed, not yellow-brown as are the cushions of the valve; cushions in other positions with 3–6 elongated curved spines, weakly hooked at tips, and smaller spines on rest of length; membranous wall of valve between and beyond cushions with faint trace of spicules.

Measurements (two specimens) in millimetres.

Head width (W)	0·84–0·85
Fore tibia width (T_w)	0·12
Fore tibia length (T_l)	0·59–0·61
Postclypeus length (Pcl)	0·19–0·20
Left mandible, apical to first marginal (L_A)	0·06
Left mandible, first to third marginal (L_1)	0·13
Left mandible, third marginal to molar (L_m)	0·05–0·06
Right mandible, apical to first marginal (R_A)	0·06–0·07
Right mandible, first to second marginal (R_1)	0·10–0·11
Right mandible, second marginal to molar (R_m)	0·05–0·06

A. sentosus has already been compared with *A. ctenopher*, *A. muricatus*, *A. pectinatus*, *A. rastratus* and *A. retifaciens*, in the descriptions to those species. *A. tranquillus* differs from *A. sentosus* in the imago in having a vestigial third apical spur of the fore tibia, a more inflated postclypeus, and proportionately smaller eyes and ocelli, separated by more than the least diameter of the latter. The worker castes are easily recognized by their very distinctive enteric valve armature. *A. spinulatus* has, again, a distinctive worker caste, with the additional character of longer apical mandibular teeth in both worker and imago, the latter caste also having a proportionately shorter right second marginal tooth.

It should be noted here that the workers and imago of *A. sentosus* are associated on a basis of probability rather than certainty, since they were not found together. To do this is always risky, but since the workers have been found both in nearby and in more distant rain forest localities, and no other species is known from the vicinity, the probability that they are correctly associated is high.

Holotype, ♂ dealate, unique, NIGERIA: Port Harcourt, 19.x.1957 (*W. Wilkinson*, No. 841/A) in British Museum (Natural History).

Paratypes. NIGERIA: Benin Province, Obanokoro, Sobo Plain (two vials), 10.i.1957 (*W. Wilkinson*), workers only, in BMNH. GUINEA: Mount Nimba (*M. Lamotte*) in AMNH.

The only biological information on this species is that it was found in and under damp rotting logs in forest.

Ateuchotermes spinulatus sp. n.

(Text-figs 450, 451, 458, 459 & 474–479; Pl. 6, figs 3–5)

Imago. (Queen, colours may be faded.) Head capsule chestnut-brown, darker above ocelli; fontanelle roughly circular, with tendency towards triangular outline, slightly depressed, less than half size of ocellus, yellow-brown; medial spot circular, flat, slightly smaller than fontanelle, coloured as head; postclypeus chestnut-brown, labrum yellow-brown; frontal marks distinct, smooth, semicircular, slightly depressed, coloured as head; antennae brown. Pronotum, meso- and metanota, chestnut-brown, transverse dark sutures present, weak on mesonotum; femora brown, tibiae yellow-brown, tarsi yellow. Abdominal tergites brown, dorsal stigmata distinct, dark sepia-brown, sternites brown, pale brown in middle, ventral stigmata sepia-brown; cerci yellow-brown.

Posterior margin of head capsule not quite evenly rounded, slightly undulating; ocelli medium sized, separated from compound eyes by distinctly more than own least diameter; postclypeus weakly inflated, Pcl/W, 0·23, posterior margin evenly rounded, median suture weak. Apical teeth of mandibles fairly short, L_A/L_1, 0·66, R_A/R_1, 1·01; subsidiary marginal tooth of left mandible with proximal end just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 7·40–9·10; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edge of first marginal equal to or slightly shorter than that of second. Meso- and metanota rather narrow at constriction, M/W, 0·26. Pilosity of head capsule a somewhat irregular pelt with emergent setae.

Measurements (one specimen) in millimetres.

Head width across eyes (W) . .	1·21
Ocellus ($O_w \times O_l$) . . .	0·09 × 0·14
Ocellus to eye (O–E) . . .	0·11
Postclypeus length (Pcl) . .	0·28
Antennal article III . . .	0·05
Antennal article IV . . .	0·06
Antennal article V . . .	0·06
Left mandible, apical to first marginal (L_A)	0·13
Left mandible, first to third marginal (L_1)	0·19
Left mandible, third marginal to molar (L_m)	0·08
Right mandible, apical to first marginal (R_A)	0·13
Right mandible, first to second marginal (R_1)	0·13
Right mandible, second marginal to molar (R_m)	0·09
Mesonotum width (M) . . .	0·32
Metanotum width (N) . . .	0·36

Worker. Head capsule pale yellow, pilosity sparse, yellow. Postclypeus moderately inflated, Pcl/W, 0·27. Apical teeth of mandibles fairly long, L_A/L_l, 0·74, R_A/R_l, 0·93; subsidiary marginal tooth of left mandible with proximal end just clear of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 14·41; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal slightly shorter than that of second, $R_A/R_l.R_m$, 14·80. Fore tibia scarcely swollen, T_l/T_w, 5·05, third apical spur short, about one-quarter length of other two. Mesenteric junction with proctodeum distinctly longer than diagonal; enteric valve nearly sessile on second pouch of proctodeum, dorsolateral in unopened abdomen; enteric valve cushion in position 1 sclerotized throughout its length, half of which protrudes beyond tips of spines of other positions, dilated end fringed with 25–28 (average 26·7) elongated spines, outer half of shaft, and concave surface of dilated end with scattered small spines, base of shaft wrinkled transversely; cushions in other positions with 3–8 (average 5·3) elongated slender slightly curved spines, hooked at tips, but not with completely recurved hooks, and smaller spines on rest of length; membranous wall of valve between and beyond cushions without detectable spicules.

FIGS 454–461. *Ateuchotermes*, imago mandibles, 454, 455, *A. retifaciens*; 456, 457, *A. sentosus*; 458, 459, *A. spinulatus*; 460, 461, *A. tranquillus*.

Measurements (one specimen) in millimetres.

Head width (W)	0·96
Fore tibia width (T_w)	0·14
Fore tibia length (T_l)	0·69
Postclypeus length (Pcl) . . .	0·26
Left mandible, apical to first marginal (L_A)	0·12
Left mandible, first to third marginal (L_l) .	0·16
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A)	0·11
Right mandible, first to second marginal (R_l)	0·12
Right mandible, second marginal to molar (R_m)	0·06

Comparisons of *A. spinulatus* have already been made with all the other species apart from *A. tranquillus.* This is distinguishable in the imago and worker castes by the shorter apical teeth of the mandibles, the longer outer edge of the right first marginal, in the imago by the vestigial third apical spur of the fore tibia, and in the worker by the distinctive enteric valve.

Holotype queen, paratype nymphs and workers from type-colony, DEMOCRATIC REPUBLIC OF CONGO: Katanga, Keyberg, near Elizabethville, 21.iv.1948 (*A. E. Emerson*) in American Museum of Natural History.

The single nest-series is recorded as from a mound about 1 foot high, 14 inches base diameter, of earth-carton with very thick walls, near the top of a rocky hill in savanna woodland.

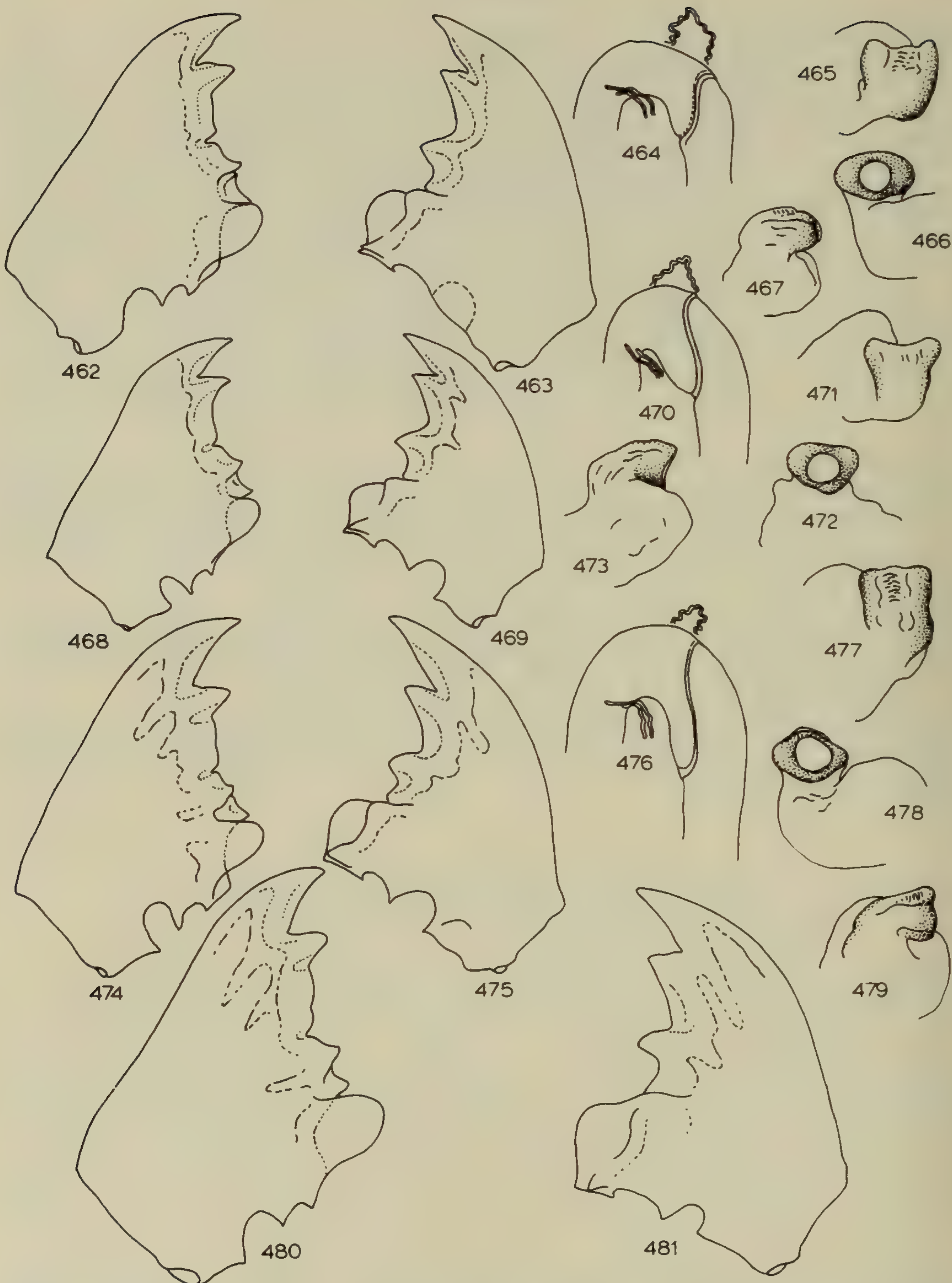
Ateuchotermes tranquillus (Silvestri) comb. n.

(Text-figs 452, 453, 460, 461, 480 & 481; Pl. 4, fig. 5)

Anoplotermes tranquillus Silvestri, 1914 : 52. LECTOTYPE ♀, GUINEA: Mamou (Silvestri Coll., Istituto di Entomologia Agraria, Naples) here designated [examined].

Imago. (Old specimens, colour faded in preservation.) Head capsule sepia-brown, darker above ocelli; fontanelle short oval, flat or slightly depressed, sometimes nearly as large as ocellus, slightly paler than head; medial spot short oval, much smaller than fontanelle, flat or slightly raised, coloured as head; postclypeus, sepia-brown, labrum yellow-brown; frontal marks almost flat, shining crescents, slightly paler than head; antennae pale brown. Pronotum, meso- and metanota, sepia-brown, transverse dark sutures distinct; femora brown, tibiae and tarsi, pale brown. Abdominal tergites sepia-brown, sternites brown, paler in middle, dorsal and ventral stigmata darker than sclerites; cerci very pale brown.

Posterior margin of head capsule evenly rounded, ocelli small, separated from compound eyes by nearly one and a half times own least diameter; postclypeus moderately inflated, Pcl/W, 0·29, posterior margin evenly rounded, median suture distinct, apart from anterior one-third. Apical teeth of mandibles short, L_A/L_l, 0·51, R_A/R_l, 0·66; subsidiary marginal tooth of left mandible clear of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 5·33; points of apical and marginal teeth of right mandible in line, anterior edge of first marginal



FIGS 462–481. *Ateuchotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seatings. 462–467, *A. retifaciens*; 468–473, *A. sentosus*; 474–479, *A. spinulatus*; 480, 481, *A. tranquillus* (mandibles somewhat worn).

longer than that of second. Meso- and metanota moderately wide at constriction, M/W, 0·30· Pilosity of head capsule forms a slightly uneven pelt with emergent setae. Fore tibia with vestigial third apical spur.

Measurements (one specimen) in millimetres.

Head width across eyes (W)	1·20
Ocellus ($O_w \times O_l$)	0·08 × 0·11
Ocellus to eye (O–E)	0·11
Postclypeus length (Pcl)	0·35
Antennal article III	0·06
Antennal article IV	0·07
Antennal article V	0·06
Left mandible, apical to first marginal (L_A)	0·10
Left mandible, first to third marginal (L_l)	0·19
Left mandible, third marginal to molar (L_m)	0·10
Right mandible, apical to first marginal (R_A)	0·10
Right mandible, first to second marginal (R_l)	0·15
Right mandible, second marginal to molar (R_m)	0·10
Mesonotum width (M)	0·36
Metanotum width (N)	0·41

Worker. Head capsule pale yellow, pilosity sparse, yellow. Postclypeus weakly inflated, Pcl/W, 0·25. Apical teeth of mandibles short, L_A/L_l, 0·63, R_A/R_l, 0·82; subsidiary marginal tooth of left mandible clear of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 10·41; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edges of marginals about equal in length, $R_A/R_l.R_m$, 11·00. Fore tibia slender, T_l/T_w, 5·73, third apical spur vestigial, extremely minute. Mesenteric junction with proctodeum diagonal; enteric valve seating connected to second pouch of proctodeum by distinct neck, dorsolateral in unopened abdomen; enteric valve cushion in position 1 only sclerotized on distal half, only about one-quarter of total length of cushion protruding beyond tips of spines of other cushions, dilated end fringed with 13–18 elongated spines, rest of length of cushion including unsclerotized base with small spines; cushions in other positions edged with 5–10 elongated curved spines, very sharply tapered so that tips appear almost blunt, and small spines on remainder of cushion; membranous wall of valve between and beyond cushions with detectable spicules.

Measurements (one specimen) in millimetres.

Head width (W)	1·10
Fore tibia width (T_w)	0·14
Fore tibia length (T_l)	0·79
Postclypeus length (Pcl)	0·27
Left mandible, apical to first marginal (L_A)	0·11
Left mandible, first to third marginal (L_l)	0·18
Left mandible, third marginal to molar (L_m)	0·06
Right mandible, apical to first marginal (R_A)	0·11

Right mandible, first to second marginal (R_1)	0·14
Right mandible, second marginal to molar (R_m)	0·08

All of the necessary comparisons of *A. tranquillus* have already been made in the discussions on the other species. As indicated in the generic discussion, the enteric valve armature of the workers forms a sequence, and apart from an un-named species known only from the workers and illustrated in Pl. 4, *A. tranquillus* represents the most primitive form.

A lectotype is designated from the existing syntype material as indicated below.

Type-material. *Anoplotermes tranquillus* Silvestri, LECTOTYPE ♀ imago, paralectotype queen, ♂ imago and three workers from type-colony, GUINEA: Mamou, 10°20′N., 12°15′W., 26.viii.1912 (*F. Silvestri*), in Silvestri Coll., Istituto di Entomologia Agraria, Portici, Naples; other paralectotypes in AMNH.

Only the type-series is known.

ANAOROTERMES gen. n.

(An—'without', aoros, Gr., 'weapon')

Type-species: *Anaorotermes echinocolon* sp. n.

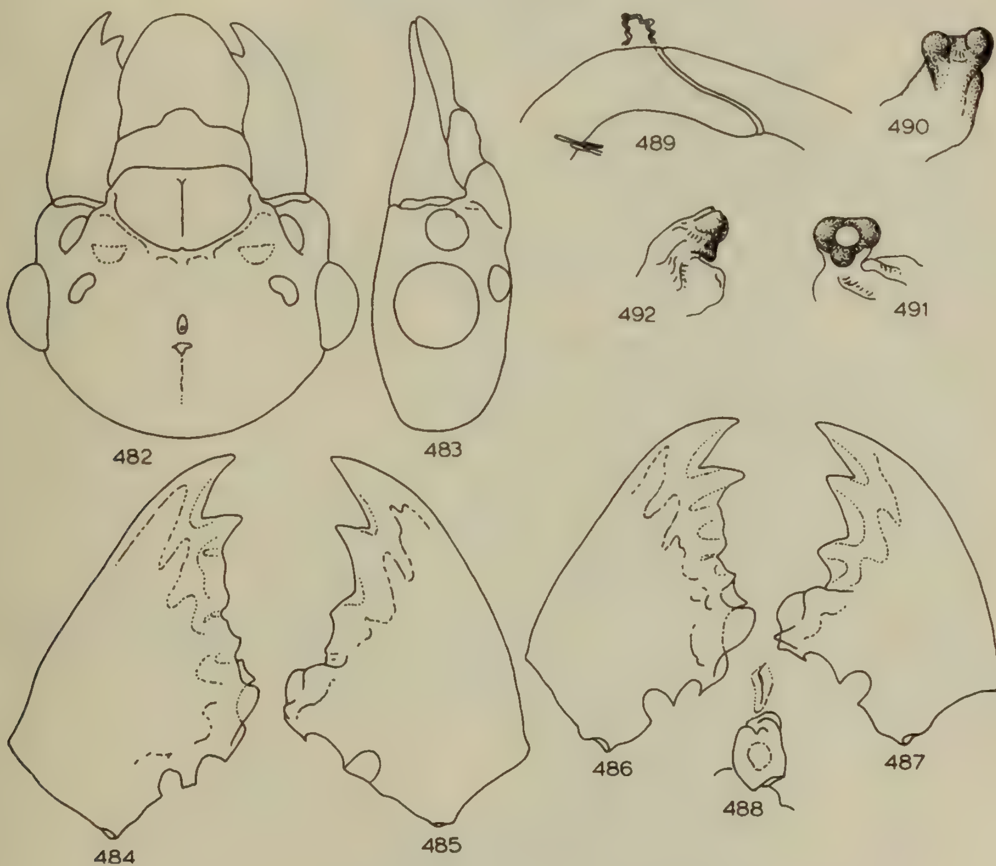
Imago. Large sized, W, 1·11–1·13. Fore tibia with three apical spurs, third well developed. Apical teeth of mandibles short, L_A/L_1, 0·49–0·51, R_A/R_1, 0·75–0·81; subsidiary marginal tooth of left mandible with proximal end clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 6·55–7·10; points of apical and marginal teeth of right mandible approximately in line, anterior edges of first and second marginals equal. Meso- and metanota moderately wide at constriction, M/W, 0·31, transverse dark sutures present; complex ratio of mandible and notal measurements, L_1/M.N, 1·41–1·55.

Worker. Large sized, W, 0·88. Fore tibia slender, T_1/T_w, 5·89, with thee apical spurs, third smaller than other two but not vestigial. Apical teeth of mandibles short, L_A/L_1, 0·53, R_A/R_1, 0·80; subsidiary marginal tooth of left mandible with proximal end just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 10·60; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edge of first marginal slightly shorter than that of second, complex ratio, $R_A/R_1.R_m$, 15·90. Mesenteric junction with proctodeum overlapping, length about twice width of mesenteron at insertion of malpighian tubules, just to right of malpighian knot. Enteric valve seating with two rather prominent outer lobes and a smaller inner lobe, attached to very muscular second pouch of proctodeum by short neck, dorsolateral in position in unopened abdomen; internal cushions of enteric valve different in every position, position 1 vestigial, retracted, unsclerotized, armature at most one or two minute scales or teeth on inner face; position 2, produced slightly through valve opening as one or two elongated sclerotized spines, rest of armature a few minute spines on unsclerotized part of cushion; position 3, distal end of cushion sclerotized, hemispherical, everted through valve opening, and covered with about 35 stout elongated curved spines, rest of cushion unsclerotized, with many small spines; position 4, produced through valve opening, distal end sclerotized with rake-like row of 7–8 elongated outwardly curved spines, rest of cushion unsclerotized, with many small spines.

The enteric valve armature of *Anaorotermes* is almost as bizarre as some of the genus *Ateuchotermes*, and may serve a similar function, though this is achieved in a different manner. The larger bilateral development of position 3 recalls *Alysco-*

termes and some *Anenteotermes*, but the structure is different in many respects. In the analysis of the similarity matrix, *Anaorotermes* comes out next to *Ateuchotermes* by single linkage clustering. Median sorting places it closer to *Aderitotermes*, and when the latent vectors of the principal co-ordinates analysis are examined, it shows relationships to *Alyscotermes*, *Amicotermes* and *Ateuchotermes* in the first six.

In the imago caste, *Anaorotermes* is distinguished from *Ateuchotermes* and *Aderitotermes* by its dense irregular head pilosity which does not form a pelt, and from *Alyscotermes*, *Astalotermes* and *Astratototermes* by its oddly shaped almost triangular fontanelle. *Amicotermes* has longer apical mandibular teeth. It is unlikely to be confused with any other genus. In the worker caste, the enteric valve armature is so distinct and characteristic that no comparisons are necessary.



Figs 482–492. *Anaorotermes echinocolon*. 482, 483, front and side views of imago head capsule; 484, 485, imago mandibles; 486–488, worker ditto, including surface view of right molar plate; 489, mesenteric-proctodeal junction showing position of malpighian knot and attachment of malpighian tubules; 490–492, views of enteric valve seating.

Anaorotermes echinocolon sp. n.

(Text-figs 482–492; Pl. 7, figs 1–3)

Imago. Head capsule sepia-brown, darker above ocelli; fontanelle much smaller than ocellus, flat or slightly depressed, broader than long, irregularly shaped, approximately triangular, very pale brown; medial spot circular, about equal in size to fontanelle, slightly raised, brown; postclypeus brown, labrum pale yellow-brown; frontal marks distinct, flat, semicircular, brown; antennae yellow. Pronotum, meso- and metanota, brown; femora pale yellow-brown, tibiae yellow, tarsi paler. Abdominal tergites brown, dorsal stigmata paler, sternites laterally yellow-brown, ventral stigmata and middle of sternites pale yellow; cerci yellow-white.

Posterior margin of head capsule not quite evenly rounded, slightly undulating; ocelli medium sized, separated from compound eyes by slightly less than own least diameter; postclypeus moderately inflated, Pcl/W, 0·26, posterior margin arched or slightly angular, not evenly rounded, median suture distinct except anterior end. Pilosity of head capsule uneven, not forming a pelt. Other characters given in generic diagnosis.

Measurements (two specimens from one locality) in millimetres.

Head width across eyes (W)	1·11–1·13
Ocellus ($O_w \times O_l$)	0·09–0·10 × 0·12–0·13
Ocellus to eye (O–E)	0·08
Postclypeus length (Pcl)	0·29
Antennal article III	0·06
Antennal article IV	0·06
Antennal article V	0·06
Left mandible, apical to first marginal (L_A)	0·09
Left mandible, first to third marginal (L_1)	0·18–0·19
Left mandible, third marginal to molar (L_m)	0·07–0·08
Right mandible, apical to first marginal (R_A)	0·10
Right mandible, first to second marginal (R_1)	0·13–0·14
Right mandible, second marginal to molar (R_m)	0·08
Mesonotum width (M)	0·34–0·35
Metanotum width (N)	0·34–0·38

Worker. Head capsule yellow-white, pilosity sparse, pale yellow. Postclypeus moderately inflated, Pcl/W, 0·28. Membranous wall of enteric valve between and beyond cushions without detectable spicules. Other characters given in generic diagnosis.

Measurements (one specimen) in millimetres.

Head width (W)	0·88
Fore tibia width (T_w)	0·11
Fore tibia length (T_l)	0·66
Postclypeus length (Pcl)	0·24
Left mandible, apical to first marginal (L_A)	0·08
Left mandible, first to third marginal (L_1)	0·15
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A)	0·09

Right mandible, first to second marginal (R_1) . . . . 0·11
Right mandible, second marginal to molar (R_m) . . . . 0·05

Since there is only one species in the genus, all the necessary comparisons are made under the generic heading. It only remains to mention that the abdomen appears to be dehiscent in *A. echinocolon*.

Holotype ♀ imago, paratype ♂ and ♀ imagos and workers from type-colony, NIGERIA: 30 miles from Lokoja on Okene Road (*W. A. Sands*, coll. No. S.2093), in British Museum (Natural History).

The single nest-series was found in an amorphous low earth mound.

ASAGAROTERMES gen. n.

(A—'without', sagaris, Gr., 'A kind of sword')

Type-species: *Asagarotermes coronatus* sp. n.

Imago. Medium-sized, W, 1·03–1·10. Fore tibia with three apical spurs, third almost equal to other two. Apical teeth of mandibles rather long, L_A/L_1, 0·78–0·80, R_A/R_1, 1·09–1·18; subsidiary marginal tooth of left mandible with proximal end just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 11·80–12·79; points of apical and marginal teeth of right mandible approximately in line, anterior edge of first marginal slightly longer than that of second, nearly equal. Meso- and metanota narrow at constriction, M/W, 0·20–0·33, transverse dark sutures strongly developed; complex ratio of mandible and notal measurements, L_1/M.N, 2·50–4·16.

Worker. Large-sized, W, 0·85–0·88. Fore tibia weakly swollen, T_1/T_W, 4·40–4·49, with three apical spurs, third about half length of other two. Apical teeth of mandibles very long, L_A/L_1, 0·96–0·99, R_A/R_1, 1·11–1·16; subsidiary marginal tooth of left mandible with proximal end just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 16·33–22·00; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edges of marginal teeth equal in length, complex ratio, $R_A/R_1.R_m$, 20·60–22·65. Mesenteric junction with proctodeum overlapping by about one and a half times width of mesenteron at insertion of malpighian tubules, anterior end of proctodeum within malpighian knot. Enteric valve seating almost without lobes, practically a rim, sessile on second pouch of proctodeum, lateral in unopened abdomen; internal cushions of enteric valve weakly developed unsclerotized, and unarmed except for a single narrow but strongly sclerotized spiked coronet-like band girdling the middle of each cushion.

This strange type of armature has not been found in any other species, nor has any precursor or even distant relative appeared among the other genera. The spikes on the 'coronet' are more numerous at its outer ends, and appear to engage with those of neighbouring cushions. It is clear from Pl. 7 that this cannot be any kind of filtering device and the only function that suggests itself is a stiffening one, keeping open the lumen of the valve whilst allowing for expansion if needed.

Asagarotermes seems to be equally isolated in the analyses of the similarity matrix to *Apagotermes* and *Amalotermes*, being the penultimate species sorted by single linkage and in the last four by median sorting. The same comments apply to its position on the vector diagrams—it tends to fall in the 'gaps' rather than to be a complete outlier.

In keying out the imago caste, *Asagarotermes* with its narrow meso- and metanotal constrictions comes nearest to *Anenteotermes* and Group I *Astalotermes*. It is larger than nearly all of these and can be distinguished from the one or two largest species by its longer apical mandibular teeth. *Aganotermes*, which combines size, narrow nota and long apical teeth, has the subsidiary marginal tooth of the left mandible level with the edge of the molar prominence, not clear of it as in *Asagarotermes*. It also has a shorter postclypeus and ocelli further from the eyes.

The worker caste of *Asagarotermes* is so distinctive in its enteric valve armature that there is no necessity for detailed comparisons with other genera.

Asagarotermes coronatus sp. n.

(Text-figs 493–502; Pl. 7, figs 4 & 5)

Imago. Head capsule dark sepia-brown, darker above ocelli; fontanelle less than half size of ocellus, oval, slightly depressed, more so at anterior end, coloured as head; medial spot equal to fontanelle or smaller, oval, flat, coloured as head; postclypeus sepia-brown, labrum yellow-brown; frontal marks distinct, semicircular, flat, coloured as head; antennae brown. Pronotum meso- and metanota, sepia-brown; femora brown, tibiae yellow-brown, tarsi yellow. Abdominal tergites brown, dorsal stigmata slightly darker, sternites pale brown, paler in mid-line, ventral stigmata darker. Cerci yellow.

Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by two-thirds, up to only slightly less than own least diameter; postclypeus moderately inflated, Pcl/W, 0·29–0·31, posterior margin bowed, not evenly rounded, median suture distinct. Pilosity of head capsule dense, uneven, thick setae, not forming a pelt.

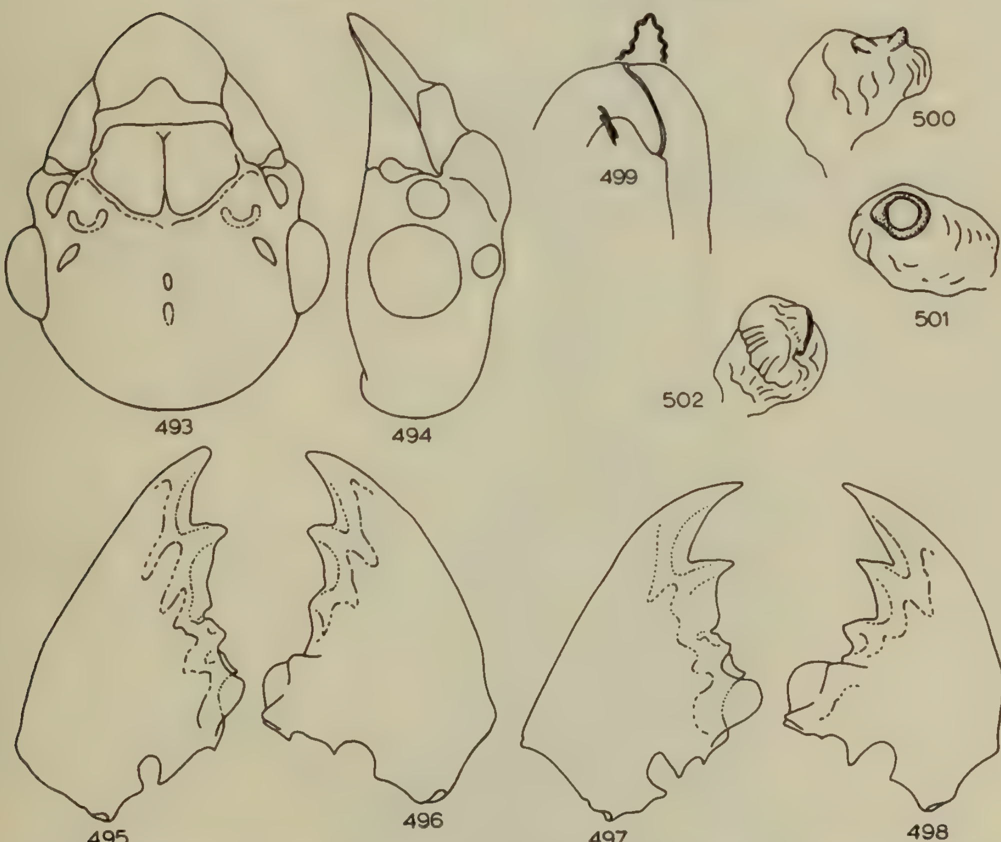
Measurements (three specimens from two nest series) in millimetres.

	Range	Mean
Head width across eyes (W)	1·03–1·10	1·050
Ocellus ($O_w \times O_l$)	0·06–0·08 × 0·10–0·13	0·07 × 0·112
Ocellus to eye (O–E)	0·06	0·059
Postclypeus length (Pcl)	0·30–0·33	0·313
Antennal article III	0·05–0·06	0·050
Antennal article IV	0·06–0·07	0·065
Antennal article V	0·06	0·062
Left mandible, apical to first marginal (L_A)	0·12–0·13	0·123
Left mandible, first to third marginal (L_1)	0·16	0·156
Left mandible, third marginal to molar (L_m)	0·06–0·07	0·064
Right mandible, apical to first marginal (R_A)	0·12–0·13	0·123
Right mandible, first to second marginal (R_1)	0·11	0·110
Right mandible, second marginal to molar (R_m)	0·07–0·08	0·075
Mesonotum width (M)	0·20–0·25	0·225
Metanotum width (N)	0·19–0·25	0·221

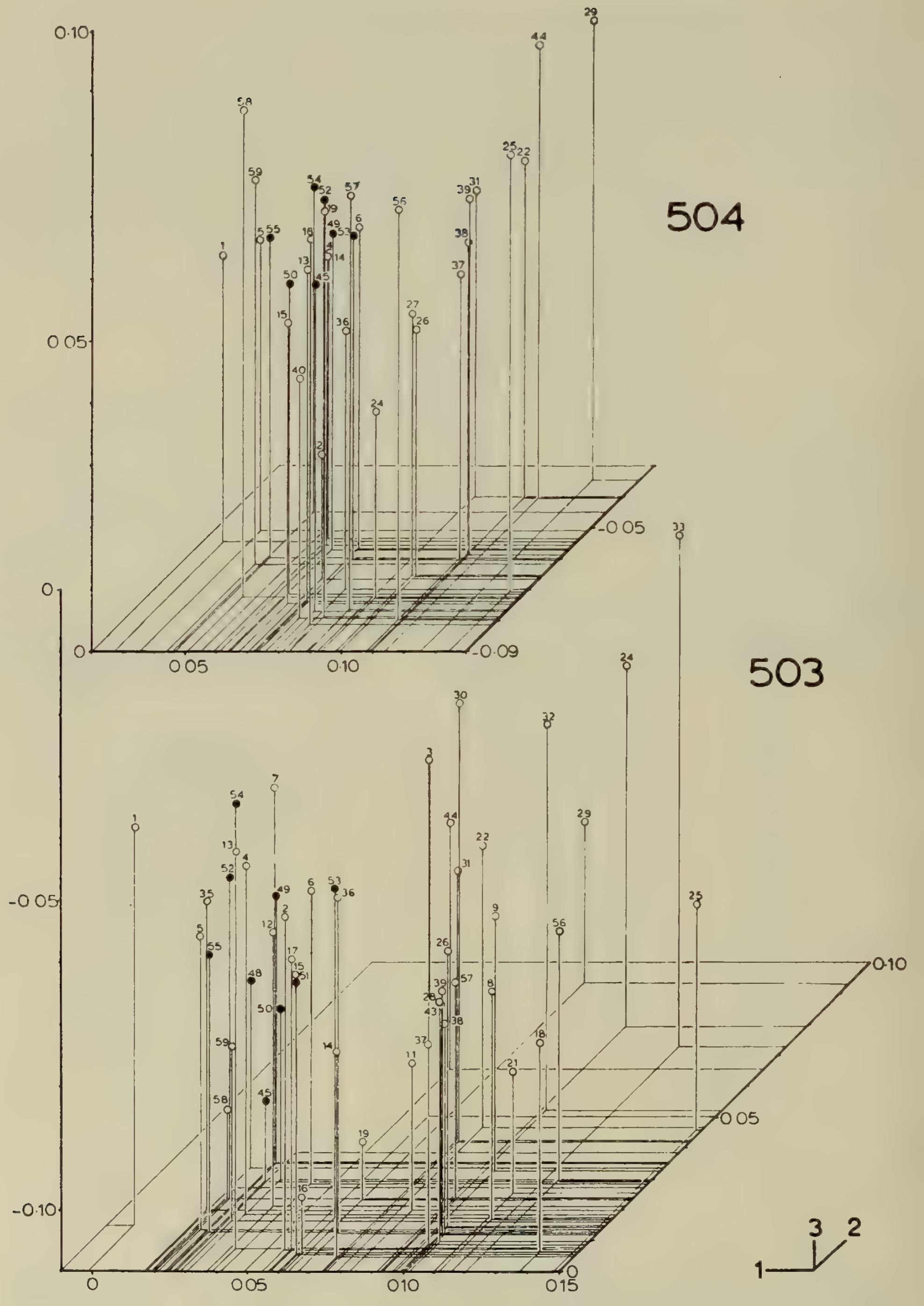
Worker. Head capsule pale yellow to yellow, pilosity yellow to orange-yellow. Postclypeus moderately inflated, Pcl/W, 0·27–0·28. Membranous wall of enteric valve beyond cushions with sparse minute spicules. Other characters given in generic diagnosis.

Measurements (two specimens from two nest series) in millimetres.

Head width (W) . . .	0·85–0·88
Fore tibia width (T_w) . . .	0·13
Fore tibia length (T_l) . . .	0·55–0·58
Postclypeus length (Pcl) . . .	0·24
Left mandible, apical to first marginal (L_A)	0·12
Left mandible, first to third marginal (L_1)	0·13
Left mandible, third marginal to molar (L_m)	0·05–0·06
Right mandible, apical to first marginal (R_A)	0·12
Right mandible, first to second marginal (R_1)	0·10–0·11
Right mandible, second marginal to molar (R_m)	0·05



FIGS 493–502. *Asagarotermes coronatus*. 493, 494, front and side views of imago head capsule; 495, 496, imago mandibles (worn); 497, 498, worker ditto; 499, mesenteric-proctodeal junction showing attachment of malpighian tubules and position of malpighian knot; 500–502, views of enteric valve seating.



FIGS 503 & 504. Three-dimensional graphs of canonical variates 1, 2 & 3 showing species of *Anenteotermes* as solid spots. 503, imago; 504, worker caste.

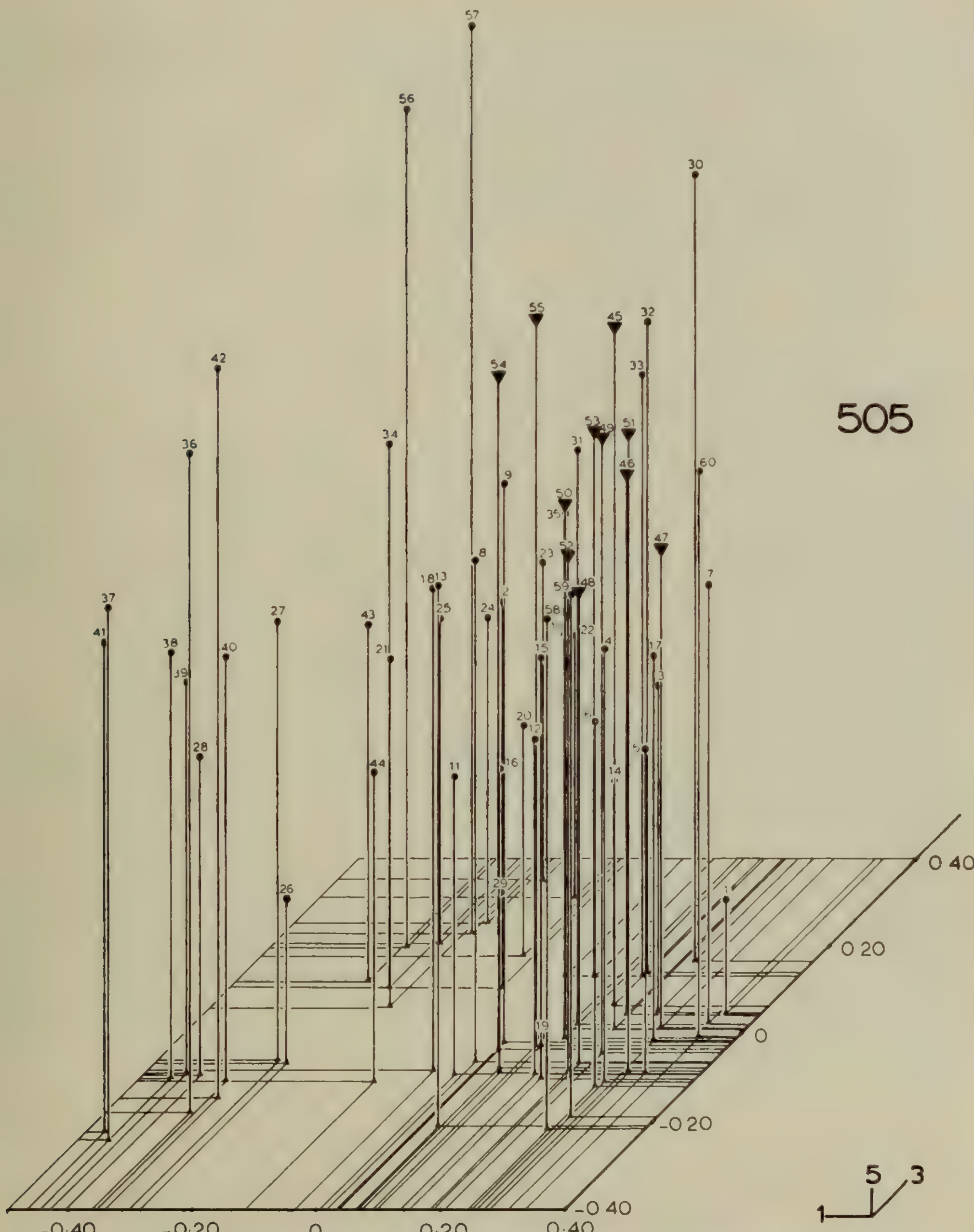


FIG. 505. Three-dimensional graph of principal co-ordinates analysis-plot of eigenvectors 1, 3 and 5 showing species of *Anenteotermes* marked by large triangles.

All the necessary comparisons of the single species are made under the generic heading. It only remains to add that there is no sign of the abdomen being dehiscent in this genus.

Holotype queen, paratype king, and worker from type-colony, DEMOCRATIC REPUBLIC OF CONGO: Katanga, Keyberg, near Elizabethville, 23.iv.1948 (*A. E. Emerson*), in American Museum of Natural History.

Other paratype material. Locality as above: 22.iv.1948 (*A. E. Emerson*), queen and workers, in AMNH.

These nest-series were both collected from *Cubitermes* mounds in seasonally flooded areas 'Dambo' in the typical *Brachystegia-Isoberlinia* woodland of the area.

ANENTEOTERMES gen. n.

(An—'without', enteon, Gr., 'fighting gear')

Type-species: *Anenteotermes disluctans* sp. n.

Imago. Very small, to medium sized, W, 0·65–1·06. Fore tibia with three apical spurs, third well developed. Apical teeth of mandibles short to moderately long, L_A/L_l, 0·42–0·76, R_A/R_l, 0·62–1·00; subsidiary marginal tooth of left mandible with proximal end just clear to distinctly clear of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 6·73–15·92. Right mandible with points of apical and marginal teeth in line, or first marginal retracted behind line from apical to second marginal; anterior edge of first marginal longer than that of second, equal to it, or shorter. Meso- and metanota narrow to fairly wide at constriction, only one species wider, M/W, 0·19–0·31 (0·26), transverse dark sutures usually present but not strongly developed; complex ratio of mandible and notal measurements, L_l/M.N, 1·70 (3·11)–5·51 (figures in parentheses represent limits of range excluding single 'unusual' species).

Worker. Very small to medium sized, W, 0·56–0·84. Fore tibia moderately to scarcely swollen, T_l/T_w, 3·58–5·00 with three apical spurs, third smaller than other two, vestigial in only one species. Apical teeth of mandibles short to moderately long, L_A/L_l, 0·46–0·73, R_A/R_l, 0·54–0·89; subsidiary marginal tooth of left mandible with proximal end just clear of molar prominence to widely separated in surface view, complex ratio, $L_A/L_l.L_m$, 9·15–18·52. Right mandible with point of first marginal slightly to distinctly behind line from apical to second marginal; anterior edge of first marginal equal to or shorter than that of second, usually shorter, complex ratio, $R_A/R_l.R_m$, 11·61–21·60. Mesenteric junction with proctodeum overlapping, elongated to form a distinct mixed segment, proximal end of proctodeum well to left of malpighian knot. Enteric valve seating weakly two- or three-lobed, third usually smaller, sessile or with short neck connecting it to second pouch of proctodeum, lateral to dorsolateral in unopened abdomen; internal cushions of enteric valve retracted or produced through valve opening, sometimes elongated and sclerotized, surfaces scaly or armed with small to elongated spines, the latter sometimes pectinate.

The most important distinguishing feature of this genus is the mixed segment of the worker gut. This character is only found in this highly developed form in two other genera, namely *Aderitotermes* and *Adaiphrotermes*. In the latter case the swollen termination of the mesenteron and lack of a third spur on the fore tibia are diagnostic. *Aderitotermes* is larger, and the mixed segment is longer. The enteric valve seating has three prominent and equal lobes and is far dorsal in position in the unopened abdomen. Nevertheless, there is probably a distinct relationship

between these two genera, *Aderitotermes* possibly being a specialized derivative from the same stem as *Anenteotermes*.

Anenteotermes itself contains a wide range of forms, some of them highly specialized in other ways. The armature of the enteric valve again shows a series of developing complexity, not so complete as that seen in *Ateuchotermes* but with enough stages to clearly show the relationship of the simpler to the more advanced forms, which were at first placed in a separate genus.

Although *Anenteotermes* forms an acceptable genus by conventional taxonomic standards, its position in the analysis of the similarity matrix is not so clear. This results very largely from the coding adopted, which treats the length of the mesenteric overlap with the proctodeum as a single multistate quantitative character. This feature is thereby weighted far below what I now consider to be its true significance. This problem is discussed in the sections on numerical taxonomy and phylogeny, but its result is to place *Anenteotermes* very close to *Astalotermes* and *Acholotermes* in the vector diagrams (Text-figs 504–505). It forms a cluster of points which scarcely overlaps with these genera but several points have their nearest neighbour outside this group. Consequently when the clustering is analysed either by single linkage or median sorting, some of the species of *Anenteotermes* are scattered among those of the other genera. This reflects a genuine, very great general similarity in characters other than the mixed segment and enteric valve armature. It is not possible to key out the imago castes of *Anenteotermes* separately from those of *Astalotermes* Group I. It seems likely that *Anenteotermes* was derived from forms resembling *Astalotermes*.

Within the genus *Anenteotermes*, as in *Astalotermes*, the species fall into natural groupings which are also indicated in the cluster analyses. However, in *Anenteotermes* they include fewer species and depend very largely on the degree of development of the enteric valve. There is little to be gained in describing the genus by sorting the species under group headings. It is sufficient to note that the main grouping consists of five species, *A. ateuchestes*, *A. cicur*, *A. disluctans*, *A. hemerus* and *A. improcinctus* in which the mixed segment is fully developed and the enteric valve is without armature other than scales. A second group is formed by *A. amachetus* and *A. nanus* in which the enteric valve has spines on the edges of the scales, more developed in the latter species. The third group consists of *A. cnaphorus* and *A. polyscolus* in which the enteric valve armature is most highly developed. There remains *A. improelatans* which should perhaps have come first since it has a shorter mixed segment and the first marginal teeth of imago and worker right mandibles are not appreciably reduced; it also has wider meso- and metanota. These characters would appear to be primitive and to link it with other genera.

Keys to Species

Imagos

1 Right mandible with anterior edge of first marginal tooth distinctly shorter than that of second marginal 2
– Right mandible with anterior edge of first marginal at least as long as that of second 3

N

2 Small, W, 0·65–0·69. Apical teeth of mandibles longer, L_A/L_1, 0·67–0·76, R_A/R_1, 0·84–1·00. Postclypeus more inflated, Pcl/W, 0·29–0·32. Fontanelle very small and indistinct, little paler than head . . . . ***nanus*** (p. 215)

– Larger, W, 0·80. Apical teeth of mandibles shorter, L_A/L_1, 0·54, R_A/R_1, 0·68. Postclypeus less inflated, Pcl/W, 0·26. Fontanelle more conspicuous, pale, contrasting with head colour . . . . . ***ateuchestes*** (p. 198)

3 Meso- and metanota proportionately wider at constriction, M/W, 0·28–0·31. Right mandible with anterior edge of first marginal tooth distinctly longer than that of second . . . . ***improelatans*** (p. 212)

– Meso- and metanota proportionately narrower at constriction, M/W, 0·19–0·26. Right mandible with anterior edges of first and second marginals equal . . 4

4 Postclypeus less inflated, Pcl/W, 0·25–0·26 5

– Postclypeus more inflated, Pcl/W, 0·28–0·34 7

5 Smaller, W, 0·69–0·79 . . . . ***polyscolus*** (p. 217)

– Larger, W, 0·87–1·06 6

6 Larger, W, 0·99–1·06. Postclypeus with sinuate posterior margin and distinct median suture . . . . ***hemerus*** (p. 209)

– Smaller, W, 0·87–0·94. Postclypeus with more or less evenly rounded but indistinct posterior margin, median suture very indistinct or absent . . ***cicur*** (p. 200)

7 Posterior margin of head capsule behind eyes evenly rounded 8

– Posterior margin of head capsule behind eyes unevenly rounded, slightly undulating ***amachetus*** (p. 195)

8 Smaller, W, 0·69–0·79 9

– Larger, W, 0·84–0·96 10

9 Fontanelle minute, vestigial, only slightly paler than head. Pilosity of head capsule dense, uneven, not forming a pelt. Postclypeus generally more inflated, Pcl/W, 0·30–0·34 . . . . ***improcinctus*** (p. 212)

– Fontanelle large, often approaching size of ocelli, usually distinctly paler than head but still visible even when coloured as head. Pilosity often even, forming a pelt with emergent setae. Postclypeus less inflated, Pcl/W, 0·23–0·31 ***polyscolus*** (p. 217)

10 Apical teeth of mandibles longer, L_A/L_1, 0·60–0·64, R_A/R_1, 0·83–0·89. (Complex ratios give clearer separation, $L_A/L_1.L_m$, 9·93–10·10, $R_1/R_A{\cdot}R_m$, 17·3–19·4) ***cnaphorus*** (p. 203)

– Apical teeth of mandibles shorter, L_A/L_1, 0·46–0·56, R_A/R_1, 0·62–0·75 ($L_A/L_1.L_m$, 6·76–8·51, $R_1/R_A.R_m$, 22·0–28·5) . . . . . . ***disluctans*** (p. 206)

Workers

1 Enteric valve cushions armed with distinct spines at their distal ends 2

– Enteric valve cushions not so armed. 4

2 Enteric valve cushions in position 3 elongated, protruding through valve opening, armed with a fringe of long pectinate spines, other cushions short, with small spines 3

– Enteric valve cushions not elongated or protruding through valve opening, armed with small spines. . . . . ***nanus*** (p. 215)

3 Enteric valve cushions of position 3 shorter and broader as in Pl. 8, fig. 3. Larger, W, 0·72–0·73. Apical teeth of mandibles longer, L_A/L_1, 0·64–0·66, R_A/R_1, 0·84–0·89 . . . . ***cnaphorus*** (p. 203)

– Enteric valve cushions of position 3 longer and narrower as in Pl. 8, figs 4–6. Smaller W, 0·60–0·64. Apical teeth of mandibles shorter, L_A/L_1, 0·50–0·60, R_A/R_1, 0·68–0·80 . . . . ***polyscolus*** (p. 217)

4 Right mandible with anterior edges of first and second marginal teeth equal in length. Mixed segment with proctodeal overlap relatively short, length less

than three times width of mesenteron at insertion of malpighian tubules, proximal end only just to left of malpighian knot . . . . . ***improelatans*** (p. 212)

– Right mandible with anterior edge of first marginal tooth distinctly shorter than that of second. Mixed segment, length of proctodeal overlap more than three times width of mesenteron, proximal end well to left of malpighian knot . . 5

5 Larger, W, 0·84. Postclypeus less inflated, Pcl/R_l, 1·61 . . . ***hemerus*** (p. 209)

– Smaller, W, 0·61–0·75. Postclypeus more inflated, Pcl/R_l, 1·63–3·00 . . . 6

6 Apical teeth of mandibles longer, L_A/L_l, 0·61–0·70, R_A/R_l, 0·77–0·84. Smaller, W, 0·60–0·63 7

– Apical teeth of mandibles shorter, L_A/L_l, 0·46–0·53, R_A/R_l, 0·54–0·65. Larger, W, 0·68–0·75 8

7 Fore tibia scarcely inflated, T_l/T_w, 5·00, with third apical spur vestigial, one-fifth or less of length of other two. Enteric valve, seating weakly three-lobed, third smaller; connected to second pouch of proctodeum by distinct neck ***amachetus*** (p. 195)

– Fore tibia inflated, T_l/T_w, 3·85–4·00 with third apical spur distinct, one-quarter or more of length of other two. Enteric valve seating almost a rim, very weakly two-lobed, sessile on second pouch of proctodeum, without a neck ***improcinctus*** (p. 210)

8 Pilosity of head capsule distinctly darker, conspicuous against paler head ***cicur*** (p. 200)

– Pilosity of head capsule, fine, pale, inconspicuous 9

9 Gambia, West Africa . . . . ***ateuchestes*** (p. 198)

– Central Africa to Uganda . . . . ***disluctans*** (p. 206)

Anenteotermes amachetus **sp. n.**

(Text-figs 506–509 & 518–523; Pl. 8, fig. 1)

Imago. Head capsule brown (queen, colours may be faded), darker above ocelli; fontanelle small, less than half size of ocellus, nearly flat, slightly ridged oval, pale yellow-brown; medial spot circular, smaller than fontanelle, flat, coloured as head; postclypeus yellow-brown, labrum yellow; frontal marks, indistinct flat yellow-brown crescents; antennae, yellow-brown. Pronotum, meso- and metanota yellow-brown, transverse sutures present; femora and tibiae pale yellow-brown, tarsi yellow. Abdominal tergites and dorsal stigmata yellow-brown, sternites and ventral stigmata pale yellow-brown, sternites paler in middle, cerci yellow.

Posterior margin of head capsule slightly undulating, not evenly rounded; ocelli medium-sized, separated from compound eyes by less than half own least diameter; postclypeus moderately inflated, Pcl/W, 0·28, posterior margin evenly rounded, median suture present but weakly developed at each end. Apical teeth of mandibles short, L_A/L_l, 0·57, R_A/R_l, 0·87; subsidiary marginal tooth of left mandible widely clear of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 11·46; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edges of marginal teeth approximately equal, complex ratio, $R_l/R_A.R_m$ (note difference from ratio used in worker caste), 21·30. Pilosity of head capsule dense, slightly uneven, brown, nearly forming a rough pelt with emergent setae.

Measurements (unique queen) in millimetres.

Head width across eyes (W) . .	0·80
Ocellus ($O_w \times O_l$) . . .	0·08 × 0·10
Ocellus to eye (O–E) . . .	0·03
Postclypeus length (Pcl) . .	0·23
Antennal article III . . .	0·02
Antennal article IV . . .	0·04
Antennal article V . . .	0·04

Left mandible, apical to first marginal (L_A)	0·07
Left mandible, first to third marginal (L_1)	0·13
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A)	0·08
Right mandible, first to second marginal (R_1)	0·09
Right mandible, second marginal to molar (R_m) . . .	0·05
Mesonotum width (M) . . .	0·20
Metanotum width (N) . . .	0·20

Worker. Head capsule and pilosity yellow, setae sparse. Postclypeus moderately inflated, Pcl/W, 0·29, Pcl/R_1, 2·26. Apical teeth of mandibles fairly short, L_A/L_1, 0·70, R_A/R_1, 0·84; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio, $L_A/L_1.L_m$, 18·10; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal shorter than that of second. $R_A/R_1.R_m$, 21·60. Fore tibia scarcely swollen, T_1/T_w, 5·00, third apical spur vestigial, less than one-fifth length of other two. Mesenteric overlap with proctodeum about three times as long as width of mesenteron at insertion of malpighian tubules; enteric valve seating with two weakly developed opposed lobes and a smaller third inner lobe, connected to second pouch of proctodeum by a distinct neck, dorsolateral in unopened abdomen; internal cushions of enteric valve all retracted, about equally developed, with scaly surface, posterior margin of each scale with one or more minute points; membranous wall of valve between and beyond cushions with rather numerous minute spicules arranged in curved rows.

Measurements (one specimen) in millimetres.

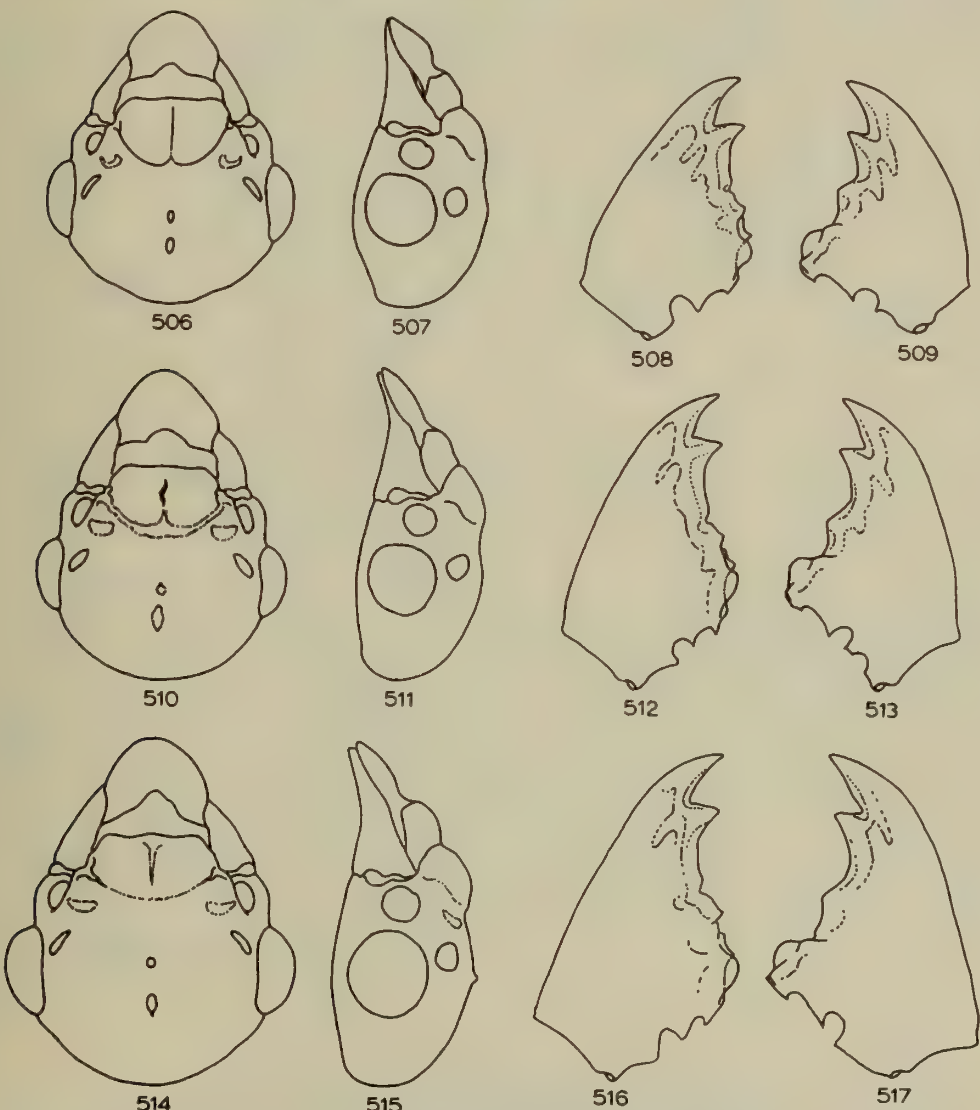
Head width (W)	0·61
Fore tibia width (T_w)	0·09
Fore tibia length (T_1)	0·44
Postclypeus length (Pcl)	0·18
Left mandible, apical to first marginal (L_A)	0·07
Left mandible, first to third marginal (L_1) .	0·10
Left mandible, third marginal to molar (L_m)	0·04
Right mandible, apical to first marginal (R_A)	0·07
Right mandible, first to second marginal (R_1)	0·08
Right mandible, second marginal to molar (R_m)	0·04

In the imago caste, *A. amachetus* is one of three species in which the back of the head behind the eyes is not evenly rounded. Of the other two species, *A. cicur* has shorter mandibular apical teeth, a less inflated postclypeus with very indistinct median suture and posterior margin, and a distinctly raised medial spot; *A. improelatans* has wider meso- and metanotal constrictions. In the worker caste, the vestigial third apical spur on the scarcely swollen fore tibia of *A. amachetus* is diagnostic. The spines of the enteric valve armature further distinguish

A. cnaphorus, *A. nanus* and *A. polyscolus*; the complete lack of points on the scales also separate the other species. The abdomen of the worker caste is dehiscent in *A. amachetus*.

Holotype queen and paratype workers from type-colony, DEMOCRATIC REPUBLIC OF CONGO: 18 km S. of Kinshasa, near Riflart, 9.vi.1948 (*A. E. Emerson*), in American Museum of Natural History.

There is no biological information on this species.



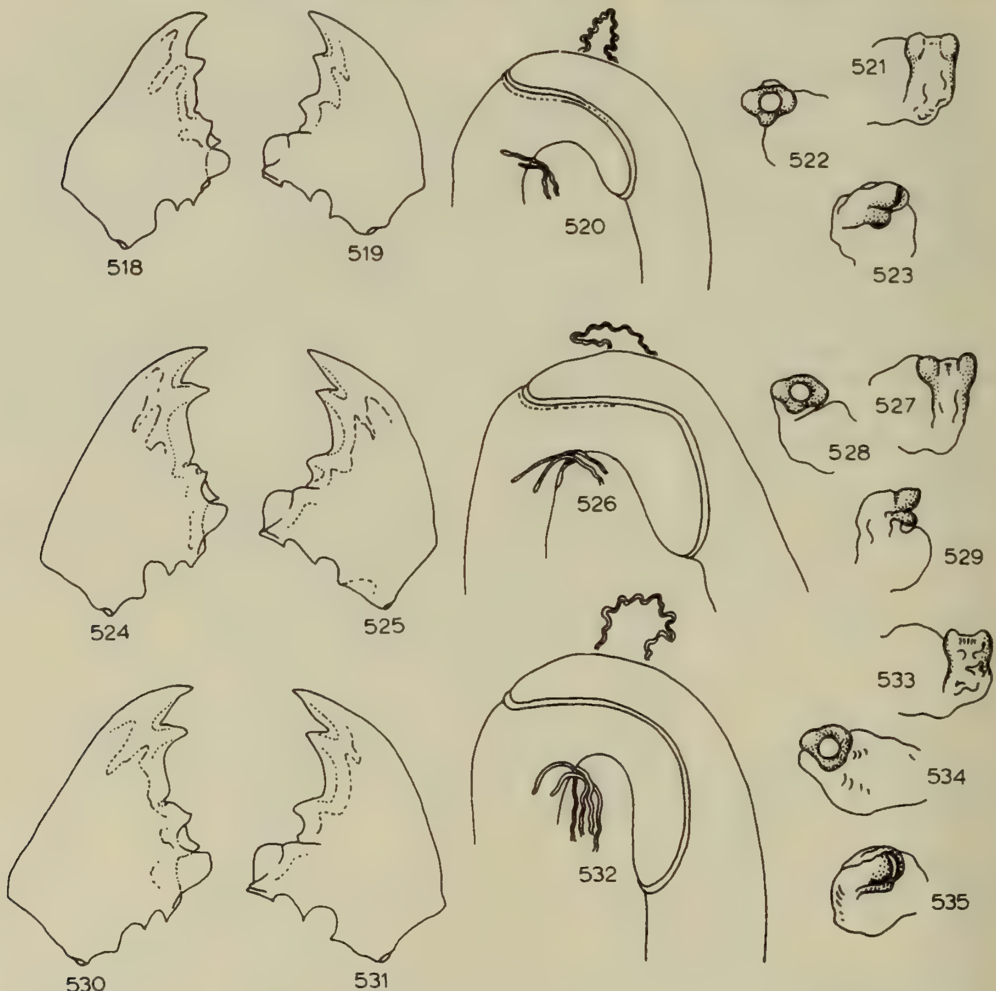
FIGS 506–517. *Anenteotermes*, imago head capsule, front and side views, and imago mandibles. 506–509, *A. amachetus*; 510–513, *A. ateuchestes* ♂; 514–517, *A. cicur*.

Anenteotermes ateuchestes sp. n.

(Text-figs 510–513 & 524–529; Pl. 7, fig. 6)

Imago. Head capsule sepia-brown, darker above ocelli; fontanelle oval, flat, about half size of ocellus, yellow, conspicuous; medial spot short oval, flat or slightly raised, smaller than fontanelle, coloured as head; postclypeus brown, labrum yellow-brown; frontal marks flat brown crescents; antennae pale brown. Pronotum brown, meso- and metanota pale brown, transverse sutures weakly developed; femora pale yellow brown, tibiae and tarsi yellow. Abdominal tergites and sternites pale brown, sternites yellow-white in middle, dorsal and ventral stigmata pale; cerci yellow.

Posterior margin of head capsule evenly rounded, ocelli medium-sized, separated from compound eyes by about two-thirds own least diameter; postclypeus moderately inflated,



FIGS 518–535. *Anenteotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seatings. 518–523, *A. amachetus*; 524–529, *A. ateuchestes*; 530–535, *A. cicur*.

Pcl/W, 0·26, posterior margin indistinct but more or less evenly rounded, median suture weakly developed. Apical teeth of mandibles short, L_A/L_1, 0·54, R_A/R_1, 0·68; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 9·97; points of apical and marginal teeth of right mandible approximately in line, anterior edge of first marginal distinctly shorter than that of second, complex ratio, $R_1/R_A.R_m$ (note difference from ratio used in worker caste), 28·0. Pilosity of head capsule short, dense, uneven, yellow-brown, not forming a pelt.

Measurements (one specimen) in millimetres.

Head width across eyes (W)	0·80
Ocellus ($O_w \times O_l$)	0·07 × 0·10
Ocellus to eye (O–E)	0·04
Postclypeus length (Pcl)	0·21
Antennal article III	0·04
Antennal article IV	0·05
Antennal article V	0·05
Left mandible, apical to first marginal (L_A)	0·08
Left mandible, first to third marginal (L_1)	0·14
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A)	0·08
Right mandible, first to second marginal (R_1)	0·11
Right mandible, second marginal to molar (R_m)	0·05
Mesonotum width (M)	0·18
Metanotum width (N)	0·18

Worker. Head capsule yellow-white, pilosity fine, short, fairly numerous, pale yellow. Postclypeus rather strongly inflated, Pcl/W, 0·32, Pcl/R_1, 2·07. Apical teeth of mandibles short, L_A/L_1, 0·49, R_A/R_1, 0·61; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 10·89; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal shorter than that of second, $R_A/R_1.R_m$, 15·80. Fore tibia scarcely swollen, T_l/T_w, 4·59, third apical spur about half length of other two, but pale and hard to see. Mesenteric overlap with proctodeum about four times as long as width of mesenteron at insertion of malpighian tubules; enteric valve seating with two moderately developed opposed lobes and a smaller third inner lobe, connected to second pouch of proctodeum by a short neck, lateral in unopened abdomen; internal cushions of enteric valve all retracted, about equally developed, with scaly surface only; membranous wall of valve between and beyond cushions with sparse minute spicules.

Measurements (one specimen) in millimetres.

Head width (W)	0·69
Fore tibia width (T_w)	0·11
Fore tibia length (T_l)	0·49
Postclypeus length (Pcl)	0·22
Left mandible, apical to first marginal (L_A)	0·06
Left mandible, first to third marginal (L_1)	0·13
Left mandible, third marginal to molar (L_m)	0·05

Right mandible, apical to first marginal (R_A)	0·07
Right mandible, first to second marginal (R_1)	0·11
Right mandible, second marginal to molar (R_m)	0·04

The short first marginal tooth of the right mandible is used in the key to the imago caste to characterize *A. ateuchestes* and *A. nanus*. It is difficult to use in that this tooth wears more readily than the second marginal and so produces a similar appearance in some other species in which it is normally about equal to the second. Thus in the imago a large specimen of *A. polyscolus* with worn mandibles may be very like *A. ateuchestes*. The head pilosity of the latter is uneven, not forming a pelt, whereas *A. polyscolus* has a very even pelt in most of its range. Other species in which the mandible character may break down are *A. amachetus*, which has already been discussed under its own heading; and *A. cnaphorus* which is larger, found in Southern Congo, and has an inconspicuous fontanelle. *A. nanus* keys out with *A. ateuchestes*, but is much smaller, with longer apical teeth and an indistinct fontanelle.

In the worker caste, the spiny enteric valve armature distinguishes *A. cnaphorus*, *A. nanus* and *A. polyscolus*. *A. improelatans* is larger with a shorter mixed segment. *A. hemerus* is much larger. *A. improcinctus* is smaller with longer mandibular apical teeth. *A. cicur* has more conspicuous head capsule setae. *A. disluctans* is indistinguishable except for a very slightly more swollen fore tibia, but is East and Central African in distribution. The abdomen of the worker appears to be dehiscent in *A. ateuchestes*.

Holotype ♂ imago, three paratype ♂ imagos and workers from type-colony, GAMBIA: 11 m. from Bathurst on Yundum Road, 12.ix.1966 (*W. A. Sands*, coll. No. S.2848) in British Museum (Natural History).

The single nest-series was found in a wide, rather flat, fairly hard mound without well defined structure on dark sandy grey soil in open bush.

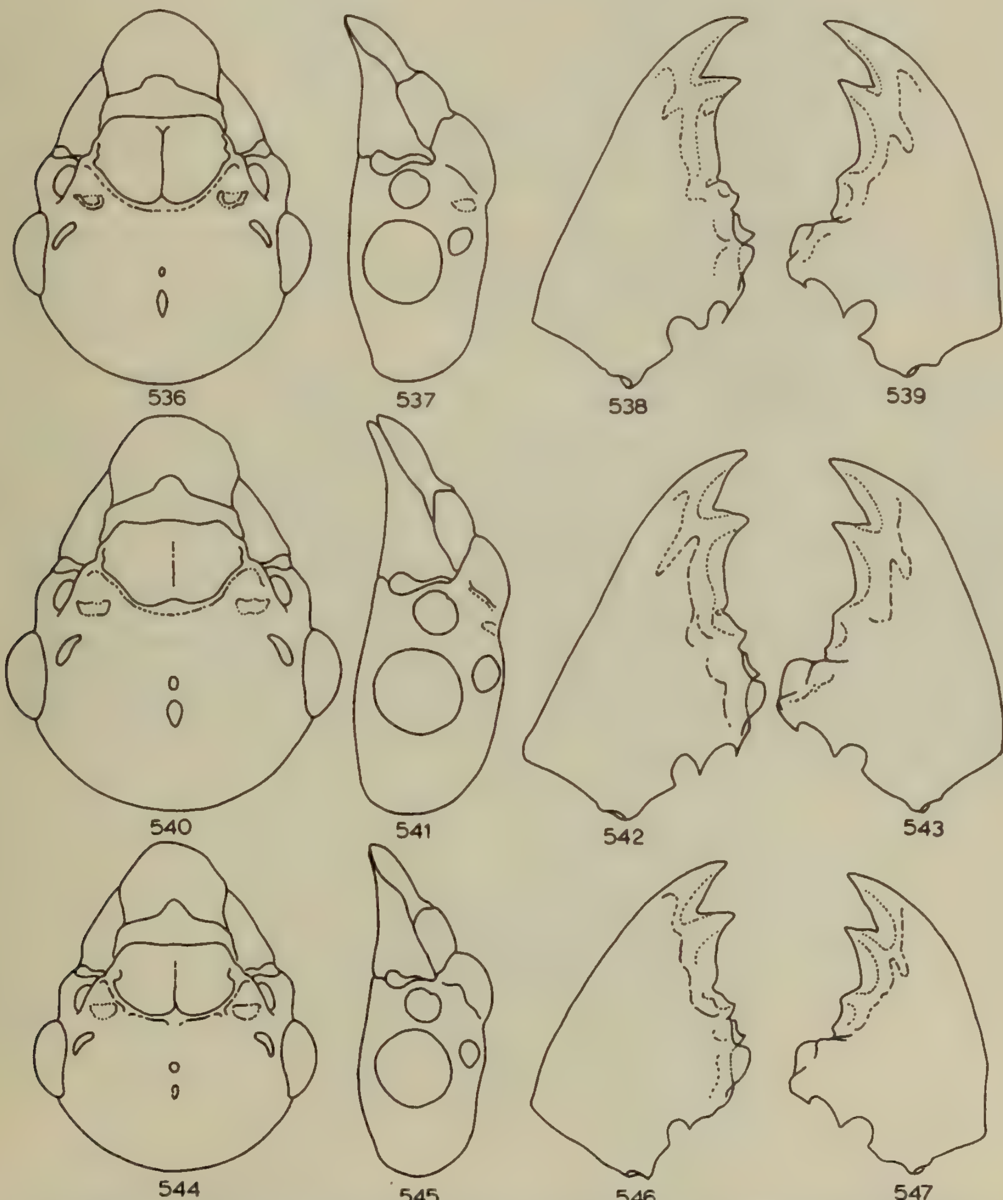
Anenteotermes cicur sp. n.

(Text-figs 514–517 & 530–535)

Imago. Head capsule dark sepia-brown, darker above ocelli; fontanelle about half size of ocellus, oval, slightly depressed, pale brown; medial spot short oval, half as large as fontanelle, slightly but distinctly raised into small bump clearly visible in profile, sepia-brown; postclypeus sepia-brown, labrum brown; frontal marks flat sepia-brown crescents; antennae yellow-brown. Pronotum sepia-brown, meso- and metanota brown, transverse suture absent on meso-, weakly developed on metanotum; femora and tibiae pale yellow-brown, tarsi yellow. Abdominal tergites sepia-brown, dorsal stigmata darker; sternites yellow-brown, paler in middle, ventral stigmata sepia-brown; cerci yellow.

Posterior margin of head capsule slightly undulating, not evenly rounded; ocelli medium-sized, separated from compound eyes by less than half up to two-thirds own least diameter; postclypeus rather weakly inflated, Pcl/W, 0·25–0·26, posterior margin somewhat indistinct, widely rounded, median suture almost absent, apical teeth of mandibles short, L_A/L_1, 0·49–0·50,

R_A/R_I, 0·70; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio, $L_A/L_I.L_m$, 6·73–7·33; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edges of marginal teeth approximately equal, complex ratio, $R_I/R_A.R_m$ (note difference from ratio used in worker caste), 21·6–22·9. Pilosity of head capsule uneven, brown, not forming a pelt.



FIGS 536–547. *Anenteotermes*, imago head capsule, front and side views, and imago mandibles. 536–539, *A. disluctans*; 540–543, *A. hemerus*; 544–547, *A. improelatans*.

Measurements (two specimens from one nest series) in millimetres.

Head width across eyes (W) .	0·87–0·94
Ocellus ($O_w \times O_l$) . . .	0·07–0·08 × 0·09–0·10
Ocellus to eye (O–E) . .	0·03–0·05
Postclypeus length (Pcl) . .	0·23–0·24
Antennal article III . . .	0·04–0·05
Antennal article IV . . .	0·04–0·05
Antennal article V . . .	0·04–0·05
Left mandible, apical to first marginal (L_A) . . .	0·08
Left mandible, first to third marginal (L_l) . . .	0·15–0·16
Left mandible, third marginal to molar (L_m)	0·07
Right mandible, apical to first marginal (R_A) . . .	0·09
Right mandible, first to second marginal (R_l) . . .	0·13
Right mandible, second marginal to molar (R_m) . . .	0·06–0·07
Mesonotum width (M) . .	0·19–0·21
Metanotum width (N) . .	0·18–0·21

Worker. Head capsule pale yellow, pilosity yellow, setae fairly numerous though not dense. Postclypeus moderately inflated, Pcl/W, 0·28, Pcl/R_l, 1·79. Apical teeth of mandibles short, L_A/L_l, 0·46, R_A/R_l, 0·58; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 9·15; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal about half as long as that of second, $R_A/R_l.R_m$, 13·52. Fore tibia weakly swollen, T_l/T_w, 4·12, third apical spur about half length of other two. Mesenteric overlap with proctodeum about four times as long as width of mesenteron at insertion of malpighian tubules; enteric valve seating with three very weakly developed lobes connected to second pouch of proctodeum by a distinct neck, lateral in unopened abdomen; internal cushions of enteric valve all retracted, about equally developed, with scaly surface; membranous wall of valve between and beyond cushions with sparse minute spicules.

Measurements (one specimen) in millimetres.

Head width (W)	0·74
Fore tibia width (T_w)	0·13
Fore tibia length (T_l)	0·53
Postclypeus length (Pcl)	0·21
Left mandible, apical to first marginal (L_A)	0·06
Left mandible, first to third marginal (L_l) .	0·14
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A)	0·07
Right mandible, first to second marginal (R_l)	0·12
Right mandible, second marginal to molar (R_m)	0·04

As already stated under *A. amachetus*, the imago caste of *A. cicur* is one of three species in which the back of the head behind the eyes is not evenly rounded. The

remaining species, *A. improelatans*, has wider meso- and metanotal constrictions, longer mandibular apical teeth, and the right first marginal tooth longer than the second. In the worker caste, it has already been compared with *A. amachetus* and *A. ateuchestes*. It is distinguished from *A. cnaphorus*, *A. nanus* and *A. polyscolus* by its unarmed enteric valve. *A. improelatans* is distinguished by the equal length of the anterior edges of first and second marginal teeth of the right mandible, and the much shorter mixed segment. The latter feature is also shorter in *A. hemerus*, though not as short as in the previously mentioned species. *A. hemerus* is also larger with less inflated postclypeus. *A. improcinctus* is smaller, with longer mandibular apical teeth, and *A. disluctans* has less conspicuous head setae. The abdomen of the worker caste is not strongly dehiscent in *A. cicur*, only about one in four preserved specimens having burst.

Holotype ♀ imago, paratype ♂ and ♀ imagos and workers from type-colony, DEMOCRATIC REPUBLIC OF CONGO: Yase, 12 km from Yangambi, 31.v.1948 (*A. E. Emerson*), in American Museum of Natural History (paratypes from type-colony also in BMNH).

Other paratype material. DEMOCRATIC REPUBLIC OF CONGO: Kivu, Irangi, 1°53′S., 28°28′E., 5.xi.1963 (*E. Ernst*) in Swiss Tropical Institute, Basle and BMNH.

There is no biological information on this species.

Anenteotermes cnaphorus sp. n.

(Text-figs 566, 575–578 & 595–600; Pl. 8, fig. 3)

Imago. Head capsule sepia-brown (queens, colours may be faded) darker above ocelli; fontanelle elongate oval, irregular in outline, somewhat indistinct, being covered with setae, equal in size to ocelli, or slightly smaller, slightly depressed, brown; medial spot oval, nearly flat, very small, coloured as head; postclypeus brown, labrum yellow-brown; frontal marks indistinct slightly depressed brown crescents; antennae yellow-brown. Pronotum, brown, meso- and metanota yellow-brown, transverse sutures present; femora and tibiae pale yellow-brown, tarsi yellow. Abdominal tergites brown, sternites yellow-brown laterally, yellow in middle, stigmata coloured as sclerites; cerci yellow.

Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by less than half own least diameter; postclypeus moderately inflated, Pcl/W, 0·29–0·31, posterior margin somewhat irregularly arched, median suture present. Apical teeth of mandibles short, L_A/L_1, 0·60–0·64, R_A/R_1, 0·83–0·89; subsidiary marginal tooth of left mandible widely clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 9·93–10·10; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edges of marginal teeth approximately equal, complex ratio, $R_1/R_A.R_m$ (note difference from ratio used in worker caste), 17·30–19·40. Pilosity of head capsule dense, fairly even, forming a rough pelt with many emergent setae, yellow-brown.

Measurements (three specimens from two localities) in millimetres.

	Range	Mean
Head width across eyes (W)	0·84–0·88	0·865
Ocellus ($O_w \times O_l$)	0·07–0·08 × 0·10–0·11	0·073 × 0·107
Ocellus to eye (O–E)	0·03–0·04	0·033
Postclypeus length (Pcl)	0·25–0·28	0·261
Antennal article III	0·02–0·04	0·032

Antennal article IV	0·04–0·05	0·044
Antennal article V	0·04–0·05	0·044
Left mandible, apical to first marginal (L_A)	0·08–0·09	0·085
Left mandible, first to third marginal (L_l)	0·14	—
Left mandible, third marginal to molar (L_m)	0·06	—
Right mandible, apical to first marginal (R_A)	0·08–0·09	0·087
Right mandible, first to second marginal (R_l)	0·10	—
Right mandible, second marginal to molar (R_m)	0·06–0·07	0·064
Mesonotum width (M)	0·19–0·20	0·197
Metanotum width (N)	0·19–0·21	0·196

Worker. Head capsule pale yellow, pilosity yellow, fairly dense but short and fine, not conspicuous. Postclypeus strongly inflated, Pcl/W, 0·31–0·34, Pcl/R_l, 2·78–2·86. Apical teeth of mandibles fairly short, L_A/L_l, 0·64–0·66, R_A/R_l, 0·84–0·89; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio, $L_A/L_l.L_m$, 13·89–14·30; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal shorter than that of second, $R_A/R_l.R_m$, 18·20–19·20. Fore tibia weakly swollen, T_l/T_w, 4·11–4·23, third apical spur approximately half length of other two. Mesenteric overlap with proctodeum more than four times as long as width of mesenteron at insertion of malpighian tubules, posterior end of mesenteron slightly swollen; enteric valve seating with two weakly developed opposed lobes, connected to second pouch of proctodeum by a short but distinct neck, lateral in unopened abdomen; internal cushions of enteric valve in positions 1 and 2 retracted, very small with scaly surface or at most one or two small spines; position 3 produced through valve opening, tapering distally, armed with 10–12 elongated pectinate spines around the edge, and other prominent spines on the posterior ends of scales on the proximal part of the cushion; position 4 retracted, but about twice as large as positions 1 and 2 and armed with prominent spines on posterior edges of scales; membranous wall of valve between and beyond cushions with sparse minute spicules.

Measurements (two specimens from separate localities) in millimetres.

Head width (W)	0·72–0·73
Fore tibia width (T_w)	0·11
Fore tibia length (T_l)	0·46–0·48
Postclypeus length (Pcl)	0·22–0·25
Left mandible, apical to first marginal (L_A)	0·07
Left mandible, first to third marginal (L_l)	0·11
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A)	0·07
Right mandible, first to second marginal (R_l)	0·08–0·09
Right mandible, second marginal to molar (R_m)	0·05

Comparisons between *A. cnaphorus* and *A. amachetus*, *A. ateuchestes* and *A. cicur* have already been made under those species. The imago of *A. disluctans* has rather

shorter mandibular apical teeth, a more prominent postclypeus with evenly rounded posterior margin, and a more distinct fontanelle. *A. hemerus* is much larger, has a less inflated postclypeus and shorter apical teeth. *A. improcinctus* and *A. nanus* are smaller, with the compound eyes markedly flattened against the sides of the head. *A. improelatans* has wider meso- and metanotal constrictions, the posterior margin of the postclypeus is evenly rounded, and the first marginal tooth of the right mandible is longer. *A. polyscolus* is smaller, usually with a large conspicuous oval

FIGS 548–565. *Anenteotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seatings. 548–553, *A. disluctans*; 554–559, *A. hemerus*; 560–565, *A. improelatans*.

fontanelle. Its different proportions clearly separated it in principal component analyses shown in Text-fig. 566.

In the worker caste, all species other than the last named are distinguishable from *A. cnaphorus* by their less developed enteric valve armature. The development of cushion position 3 reaches its most specialized form and maximum elongation in *A. polyscolus*. In *A. cnaphorus* it is shorter, slightly wider and tapers more sharply to the tip. This species also has slightly longer mandibular apical teeth, a slightly less swollen fore tibia and is generally a little longer. The abdomen is definitely dehiscent in *A. cnaphorus*.

Holotype ♀ queen, paratype king and workers from type-colony, DEMOCRATIC REPUBLIC OF CONGO: Katanga, Keyberg, near Elizabethville, 23.iv.1948 (*Winifred Emerson*), in American Museum of Natural History.

Other paratype material. DEMOCRATIC REPUBLIC OF CONGO: Katanga, 5 km E. of Elizabethville, 26.iv.1948 (*A. E. Emerson*) in AMNH. MALAWI: 7 m. from Nkata Bay on Ekwendeni Road, 22.ix.1953 (*W. A. Sands & W. Wilkinson*) in BMNH.

The type-colony was found in a small soft mound 4 inches high in 'Dambo', i.e., seasonally flooded grassland. Other records are from the surface layers of a *Macrotermes goliath* mound, and from soil at the foot of an old tree stump.

***Anenteotermes disluctans* sp. n.**

(Text-figs 536–539 & 548–553; Pl. 7, fig. 7)

Imago. Head capsule sepia-brown, darker above ocelli; fontanelle about half as long as ocellus, rather narrow oval, flat or slightly depressed, yellow; medial spot short oval, smaller than fontanelle, flat, coloured as head; postclypeus brown, labrum yellow-brown; frontal marks small slightly depressed brown crescents; antennae yellow-brown. Pronotum brown, meso- and metanota yellow-brown, transverse sutures weak if present; femora pale yellow-brown, tibiae and tarsi yellow. Abdominal tergites yellow-brown, sternites pale yellow-brown laterally, yellow in middle, dorsal and ventral stigmata dark; cerci yellow.

Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by less than half up to nearly own least diameter, postclypeus moderately to strongly inflated, Pcl/W, 0·28–0·34, posterior margin evenly rounded though not always distinct, median suture present. Apical teeth of mandibles short, L_A/L_1, 0·46–0·56, R_A/R_1, 0·62–0·75; subsidiary marginal tooth of left mandible well clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 6·76–8·51, point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edges of marginal teeth equal, complex ratio, $R_1/R_A.R_m$ (note difference from ratio used in worker caste) 22·0–28·5. Pilosity of head capsule brown, dense, uneven, not forming a pelt.

Measurements (nine specimens from five localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	0·88–0·96	0·918 ± 0·028
Ocellus ($O_w \times O_l$)	0·06–0·09 × 0·09–0·13	0·075 ± 0·007 × 0·102 ± 0·012
Ocellus to eye (O–E)	0·04–0·06	0·044 ± 0·008
Postclypeus length (Pcl)	0·25–0·31	0·286 ± 0·010
Antennal article III	0·03–0·05	0·031 ± 0·007
Antennal article IV	0·04–0·06	0·047 ± 0·006
Antennal article V	0·04–0·05	0·044 ± 0·004

Left mandible, apical to first marginal (L_A) . . .	0·08–0·09	0·084 ± 0·005
Left mandible, first to third marginal (L_l) . . .	0·15–0·19	0·166 ± 0·006
Left mandible, third marginal to molar (L_m) . . .	0·06–0·08	0·066 ± 0·004
Right mandible, apical to first marginal (R_A) . . .	0·08–0·09	0·088 ± 0·004
Right mandible, first to second marginal (R_l) . . .	0·11–0·15	0·133 ± 0·004
Right mandible, second marginal (R_m)	0·05–0·06	0·060 ± 0·003
Mesonotum width (M) . .	0·19–0·23	0·202 ± 0·014
Metanotum width (N) . .	0·18–0·21	0·198 ± 0·013

Worker. Head capsule and pilosity yellow-white, setae rather numerous but short, fine and pale, inconspicuous. Postclypeus moderately to strongly inflated, Pcl/W, 0·27–0·36, Pcl/R_l, 1·63–2·50. Apical teeth of mandibles short, L_A/L_l, 0·46–0·53, R_A/R_l, 0·54–0·65; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio, $L_A/L_l.L_m$, 9·63–11·85; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal shorter than that of second, $R_A/R_l.R_m$, 11·61–16·65. Fore tibia slightly swollen, T_l/T_w, 4·18–4·41, third apical spur well developed, almost as large as other two. Mesenteric overlap with proctodeum

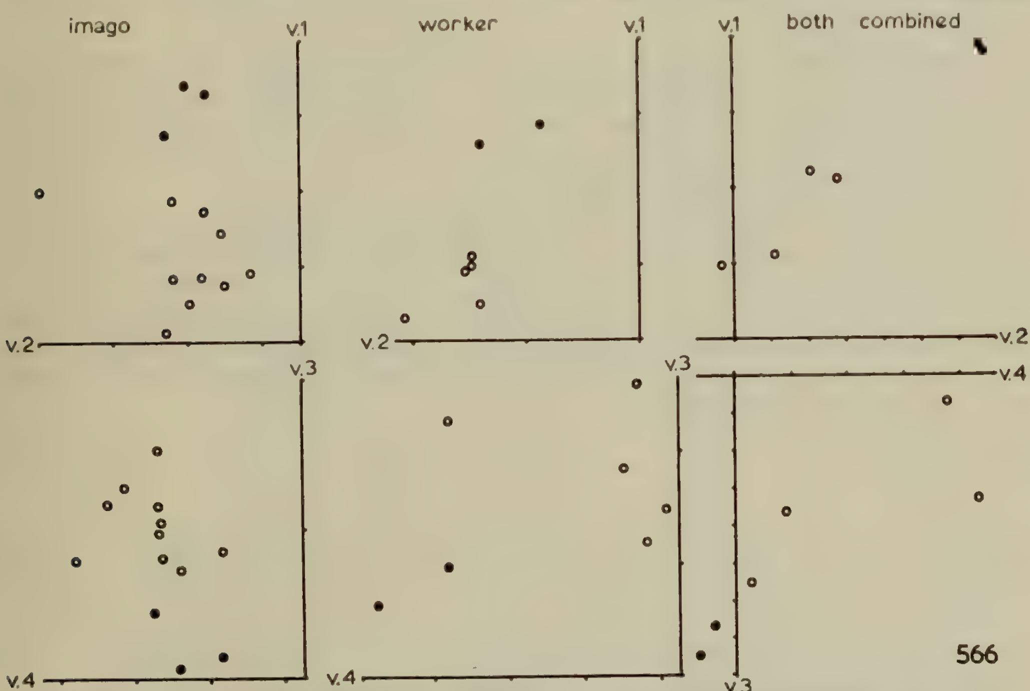


FIG. 566. *Anenteotermes*, distinction between *A. cnaphorus* (spots) and *A. polyscolus* (rings). Plots of principal component scores (transformed variables) corresponding to first, second, third and fourth latent roots of the correlation matrices of the two castes separately and combined.

a little over four times as long as width of mesenteron at insertion of malpighian tubules; enteric valve seating weakly three-lobed, third inner lobe smaller than outer two, connected to second pouch of proctodeum by a short neck, lateral in postion in unopened abdomen; internal cushions of enteric valve all retracted with scaly surface only, positions 3 and 4 slightly larger than 1 and 2; membranous wall of valve between and beyond cushions with sparse minute spicules.

Measurements (five specimens from five localities) in millimetres.

	Range	Mean
Head width (W)	0·68–0·75	0·726
Fore tibia width (T_w)	0·11–0·12	0·118
Fore tibia length (T_l)	0·49–0·51	0·506
Postclypeus length (Pcl)	0·19–0·26	0·210
Left mandible, apical to first marginal (L_A)	0·05–0·08	0·069
Left mandible, first to third marginal (L_l)	0·12–0·15	0·136
Left mandible, third marginal to molar (L_m)	0·04–0·05	0·047
Right mandible, apical to first marginal (R_A)	0·06–0·08	0·069
Right mandible, first to second marginal (R_l)	0·09–0·13	0·113
Right mandible, second marginal to molar (R_m)	0·04–0·05	0·043

A. disluctans has already been compared with the species preceding it alphabetically. In the imago caste it is smaller than *A. hemerus*, and has an evenly rounded postclypeus. *A. improcinctus*, *A. nanus* and *A. polyscolus* are smaller than *A. disluctans* and *A. improelatans* has wider meso- and metanotal constrictions, and a vestigial fontanelle.

In the worker caste, *A. hemerus* is again larger, *A. nanus* and *A. polyscolus* have armed enteric valves, and, like *A. improcinctus* are also smaller. The latter species has longer mandibular apical teeth, and the fore tibia is somewhat more swollen. In *A. improelatans* the mixed segment is much shorter and the first marginal tooth of the right mandible is equal to the second.

The material now included in *A. disluctans* was at first separated into two species, one from Uganda and the other from Central Africa. However, it has not been found possible to distinguish the two groups of specimens taxonomically and they are therefore described as one. Some doubt remains because of slight differences in the proportionate sizes of certain parts such as the imago antennal articles. For this reason the central African material is deliberately excluded from the paratype series as a tentative identification.

The abdomen of the worker caste appears to be at least weakly dehiscent in *A. disluctans*.

Holotype ♀ imago, paratype ♂ and ♀ imagos and workers from type-colony, UGANDA: Kawanda, 1948 (*W. V. Harris*, coll. No. 508) in British Museum (Natural History).

Other paratype material. UGANDA: Hoima, 28.viii.1949 (*M. Lüscher*). DEMOCRATIC REPUBLIC OF CONGO: Near Stanleyville (*A. Kohl*), both in AMNH.

Material excluded from type-series. DEMOCRATIC REPUBLIC OF CONGO: Katanga, Keyberg, 10 km S. of Elizabethville, 10.iv.1948 (*A. Emerson*), in AMNH. ZAMBIA: Kitwe (two vials), 25.i.1957 (*W. G. H. Coaton*) in N.C.I., Pretoria.

There is no biological information on this species.

Anenteotermes hemerus sp. n.

(Text-figs 540–543 & 554–559; Pl. 7, fig. 8)

Imago. Head capsule dark sepia-brown, darker above ocelli; fontanelle short oval, about half as large as ocellus, slightly depressed, brown; medial spot oval, flat, smaller than fontanelle, coloured as head; postclypeus sepia-brown, labrum yellow-brown; frontal marks flat crescents, coloured as head; antennal yellow-brown. Pronotum sepia-brown, meso- and metanota yellow-brown, transverse suture only present on mesonotum; femora pale yellow-brown, tibiae and tarsi yellow. Abdominal tergites and dorsal and ventral stigmata brown, sternites pale brown laterally, paler in middle; cerci yellow.

Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by two-fifths to slightly more than half own least diameter; postclypeus rather weakly inflated, Pcl/W, 0·25, posterior margin bowed, median suture present, weak at each end. Apical teeth of mandibles short, L_A/L_1, 0·54–0·56, R_A/R_1, 0·66–0·69; subsidiary marginal tooth of left mandible clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$ 7·37–8·70; points of apical and marginal teeth of right mandible more or less in line, anterior edges of marginal teeth approximately equal or first slightly longer than second, complex ratio, $R_1/R_A.R_m$ (note difference from ratio used in worker caste), 20·60–22·30. Pilosity of head capsule uneven, brown, not forming a pelt.

Measurements (two specimens from one nest-series) in millimetres.

Head width across eyes (W) .	0·99–1·06
Ocellus ($O_w \times O_l$) . . .	0·08–0·09 × 0·11–0·14
Ocellus to eye (O–E) . .	0·04–0·05
Postclypeus length (Pcl) . .	0·25–0·26
Antennal article III . . .	0·05
Antennal article IV . . .	0·05–0·06
Antennal article V . . .	0·06
Left mandible, apical to first marginal (L_A) . . .	0·09–0·10
Left mandible, first to third marginal (L_1) . . .	0·17–0·18
Left mandible, third marginal to molar (L_m)	0·07
Right mandible, apical to first marginal (R_A) . . .	0·09
Right mandible, first to second marginal (R_1) . . .	0·13–0·14
Right mandible, second marginal to molar (R_m) . . .	0·07
Mesonotum width (M) . .	0·22
Metanotum width (N) . .	0·21

Worker. Head capsule yellow, pilosity orange-yellow, setae numerous but fine and not conspicuous. Postclypeus rather weakly inflated, Pcl/W, 0·26, Pcl/R_1, 1·61. Apical teeth of mandibles short, L_A/L_1, 0·57, R_A/R_1, 0·64; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 10·31; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edge of first marginal distinctly shorter than that of second, $R_A/R_1.R_m$, 12·07. Fore tibia slightly swollen, T_l/T_w, 4·50, third apical spur about half as long as other two. Mesenteric overlap with proctodeum about four times as long as width of mesenteron at insertion of malpighian tubules; enteric valve seating very weakly three-lobed, connected to second pouch of proctodeum by a short neck, lateral in position in unopened abdomen; internal cushions of enteric valve all

retracted and about equally developed, with scaly surface only; membranous wall of valve between cushions with very sparse minute spicules.

Measurements (one specimen) in millimetres.

Head width (W)	0·84
Fore tibia width (T_w)	0·13
Fore tibia length (T_l)	0·56
Postclypeus length (Pcl)	0·22
Left mandible, apical to first marginal (L_A)	0·09
Left mandible, first to third marginal (L_l)	0·15
Left mandible, third marginal to molar (L_m)	0·06
Right mandible, apical to first marginal (R_A)	0·09
Right mandible, first to second marginal (R_l)	0·13
Right mandible, second marginal to molar (R_m)	0·05

A. hemerus is the largest species of the genus. Comparisons with *A. amachetus*, *A. ateuchestes*, *A. cicur*, *A. cnaphorus* and *A. disluctans* have already been made. Of the remaining species, *A. improcinctus*, *A. nanus* and *A. polyscolus* are all much smaller and so unlikely to be confused with it. *A. improelatans* is also smaller, but less markedly so. In the imago it is recognizable by its less constricted meso- and metanota, and very small fontanelle; in the worker caste the first marginal tooth of the right mandible is as long as the second and the mixed segment of the gut is shorter.

The abdomen of the worker appears to be dehiscent in *A. hemerus*.

Holotype ♀ imago, paratype ♂ and ♀ imagos and workers from type-colony, SUDAN: Mount Bangenze, 4°30′N., 30°00′E., 15.v.1937 (*J. G. Myers*) in American Museum of Natural History; paratype ♀ and ♂ imagos and workers from type-colony also in BMNH.

Only the type nest-series is known; there is no biological information. It is known to the Zande tribesmen in the area as 'Akpiaru'.

Anenteotermes improcinctus sp. n.

(Text-figs 567–570 & 583–588)

Imago. Head capsule sepia-brown, darker above ocelli; fontanelle very small elongate oval, flat or slightly depressed, brown, almost obsolete in some specimens; medial spot also very small, elongate oval, flat, coloured as head; postclypeus brown, labrum pale yellow-brown; frontal marks smooth, flat, semicircular, coloured as head; antennae pale brown to brown. Pronotum, meso- and metanota, brown, transverse sutures present; femora and tibiae pale brown, tarsi pale yellow. Abdominal tergites and dorsal stigmata brown, sternites pale brown, paler in middle, ventral stigmata pale; cerci pale yellow-brown.

Posterior margin of head capsule evenly rounded; ocelli rather small, separated from somewhat flattened compound eyes by one-quarter to slightly over one-third own least diameter; postclypeus rather strongly inflated, Pcl/W, 0·30–0·34, posterior margin evenly rounded, median suture only distinct in middle. Apical teeth of mandibles short, L_A/L_l, 0·50–0·60, R_A/R_l,

0·67–0·86; subsidiary marginal tooth of left mandible only just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 11·42–12·91; point of first marginal tooth of right mandible only slightly behind line of apical to second marginal, anterior edges of marginal teeth approximately equal in length, complex ratio, $R_1/R_A.R_m$ (note difference from ratio used in worker caste), 26·00–30·00. Pilosity of head capsule uneven, yellow, not forming a pelt.

Measurements (four specimens from two localities) in millimetres

	Range	Mean
Head width across eyes (W)	0·69–0·71	0·703
Ocellus ($O_w \times O_l$)	0·07–0·08 × 0·09	0·070 × 0·088
Ocellus to eye (O–E)	0·02–0·03	0·021
Postclypeus length (Pcl)	0·21–0·24	0·228
Antennal article III	0·02–0·03	0·022
Antennal article IV	0·03–0·04	0·033
Antennal article V	0·03	0·029
Left mandible, apical to first marginal (L_A)	0·06–0·07	0·066
Left mandible, first to third marginal (L_1)	0·12–0·13	0·120
Left mandible, third marginal to molar (L_m)	0·04–0·05	0·046
Right mandible, apical to first marginal (R_A)	0·06–0·08	0·069
Right mandible, first to second marginal (R_1)	0·09–0·10	0·091
Right mandible, second marginal to molar (R_m)	0·05	0·048
Mesonotum width (M)	0·16–0·17	0·159
Metanotum width (N)	0·15–0·16	0·155

Worker. Head capsule yellow-white, pilosity sparse, fine, yellow. Postclypeus rather strongly inflated, Pcl/W, 0·35–0·36, Pcl/R_1, 2·66–3·00. Apical teeth of mandibles short, L_A/L_1, 0·61–0·63, R_A/R_1, 0·77–0·78; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 17·87–18·52; point of first margina tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal shorter than that of second, $R_A/R_1.R_m$, 20·90–21·10. Fore tibia moderately swollen, T_l/T_w, 3·85–4·00, third apical spur short, about one-third length of other two. Mesenteric overlap with proctodeum about four times as long as width of mesenteron at insertion of malpighian tubules, or a little less; enteric valve seating scarcely lobed, almost a rim, sessile on second pouch of proctodeum, dorso-lateral in position in unopened abdomen; internal cushions of enteric valve all retracted, about equally developed, with scaly surface only; membranous wall of valve between and beyond cushions with very sparse minute spicules.

Measurements (two specimens from different localities) in millimetres.

Head width (W)	0·60–0·63
Fore tibia width (T_w)	0·10
Fore tibia length (T_l)	0·38–0·40
Postclypeus length (Pcl)	0·21–0·23
Left mandible, apical to first marginal (L_A)	0·06
Left mandible, first to third marginal (L_1)	0·10
Left mandible, third marginal to molar (L_m)	0·03

Right mandible, apical to first marginal (R_A)	0·06
Right mandible, first to second marginal (R_1)	0·08
Right mandible, second marginal to molar (R_m)	0·04

A. improcinctus is one of the three smallest species of the genus, only *A. nanus* being smaller, and this species has the first marginal tooth of the right mandible shorter than the second in the imago, longer apical teeth in both castes, and an armed enteric valve in the worker. *A. polyscolus* is about the same size, but in the imago the fontanelle is larger and more conspicuous and the pilosity forms a pelt; the apical teeth are longer in both castes and the characteristic enteric valve is easily recognized. The remaining species, *A. improelatans*, is larger and has less constricted meso- and metanota in the imago; the worker has a shorter mixed segment. The abdomen of the worker caste appears to be dehiscent in *A. improcinctus*.

Holotype ♀ imago, paratype ♂ and ♀ imagos, and workers from type-colony, NIGERIA: Northern Region, 20 miles from Yandev (near Gboko) on Makurdi Road, 25.ii.1958 (*W. A. Sands* Coll., No. S.1928), in British Museum (Natural History).

Other paratype material. NIGERIA: Eastern Region, Nsukka, 20 miles from Enugu on Oturkpo Road, 5.iii.1958 (*W. A. Sands* No. S.2040); Northern Region, Beli, 20 m. S.E. of Bakundi on Taraba River, 19.v.1957 (*W. A. Sands*) also in BMNH. IVORY COAST: Séguéla, 24.vi.1964 (*E. Ernst*) in Swiss Tropical Institute, Basle.

Anenteotermes improelatans sp. n.

(Text-figs 544–547 & 550–565)

Imago. Head capsule dark chestnut-brown, not appreciably darker above ocelli; fontanelle vestigial, flat, minute oval spot, slightly paler than head; medial spot circular, flat, slightly larger than fontanelle, coloured as head; postclypeus brown, labrum yellow-brown; frontal marks semicircular, distinct, flat, brown; antennae pale brown. Pronotum, meso- and metanota, sepia-brown, transverse sutures weak or absent; femora brown, tibiae yellow-brown tarsi yellow. Abdominal tergites brown, dorsal stigmata sepia-brown, sternites pale brown yellow-brown in middle, ventral stigmata brown; cerci yellow.

Posterior margin of head capsule slightly undulating, not quite evenly rounded; ocelli medium-sized, separated from compound eyes by up to half own least diameter; postclypeus moderately inflated, Pcl/W, 0·27–0·31, posterior margin more or less evenly rounded, median suture distinct. Apical teeth of mandibles short, L_A/L_1, 0·54–0·59, R_A/R_1, 0·74–0·82; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio, $L_A/L_1.L_m$, 8·75–9·89; points of apical and marginal teeth of right mandible in line, anterior edge of first marginal distinctly longer than that of second, complex ratio, $R_1/R_A.R_m$ (note difference from ratio used in worker caste), 19·5–26·5. Pilosity of head capsule relatively even, forming a pelt, but with some uneven emergent setae, brown. Meso- and metanota wider at constrictions, M/W, 0·28–0·31.

Measurements (six specimens from three nest series) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W) .	0·85–0·94	0·890 ± 0·041
Ocellus ($O_w \times O_l$) . . .	0·07–0·08 × 0·09–0·10	0·074 ± 0·005 × 0·096 ± 0·007
Ocellus to eye (O–E) . .	0·02–0·04	0·029 ± 0·007

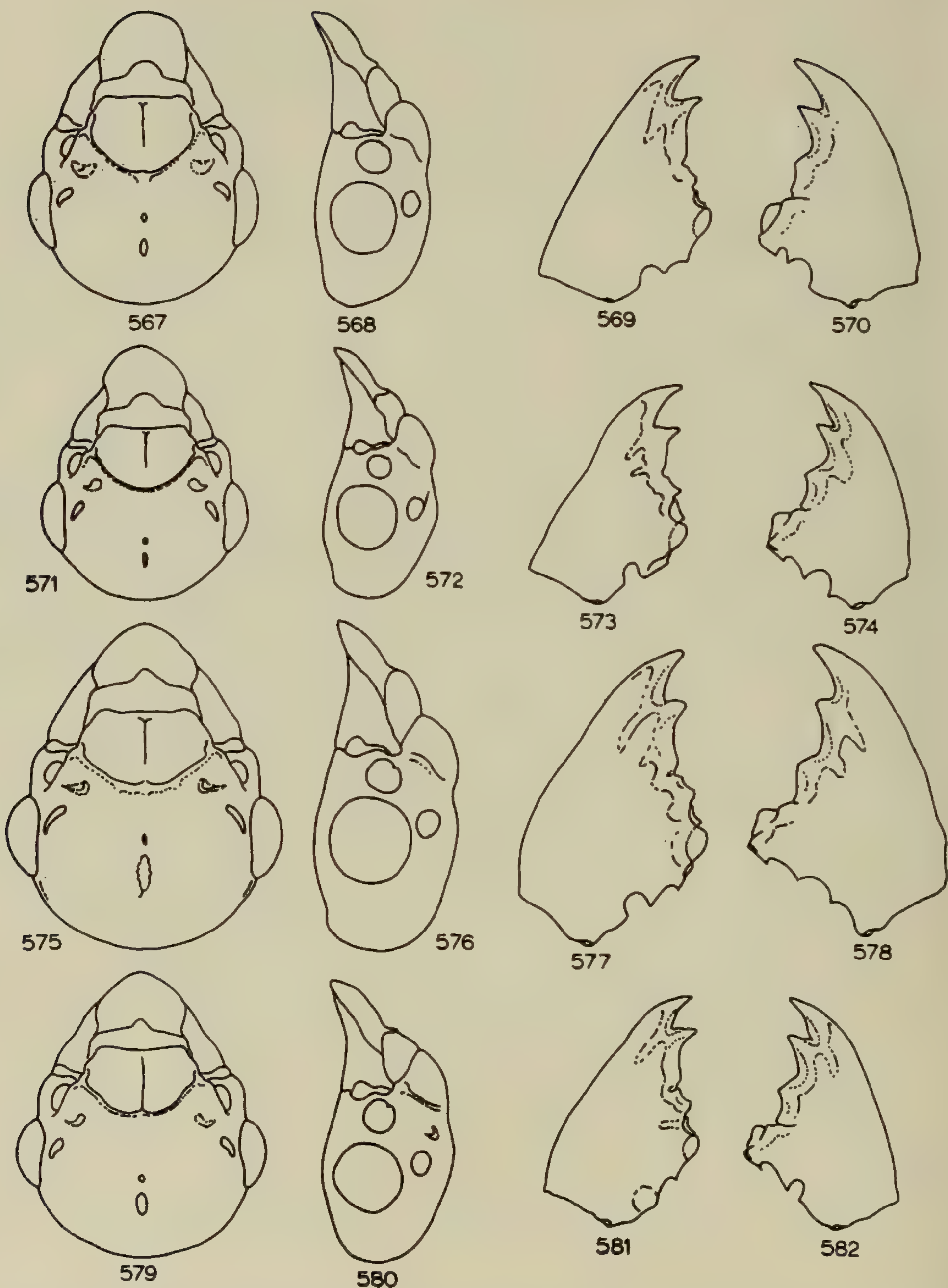
Postclypeus length (Pcl)	0·25–0·29	0·264 ± 0·106
Antennal article III	0·02–0·24	0·029 ± 0·006
Antennal article IV	0·04–0·05	0·041 ± 0·005
Antennal article V	0·04–0·05	0·040 ± 0·004
Left mandible, apical to first marginal (L_A)	0·07–0·08	0·075 ± 0·004
Left mandible, first to third marginal (L_1)	0·12–0·14	0·133 ± 0·007
Left mandible, third marginal to molar (L_m)	0·06	0·061 ± 0·001
Right mandible, apical to first marginal (R_A)	0·08–0·09	0·080 ± 0·004
Right mandible, first to second marginal (R_1)	0·09–0·11	0·102 ± 0·004
Right mandible, second marginal to molar (R_m)	0·05–0·06	0·057 ± 0·005
Mesonotum width (M)	0·24–0·28	0·260 ± 0·020
Metanotum width (N)	0·24–0·29	0·270 ± 0·020

Worker. Head capsule pale yellow, pilosity yellow, setae sparse. Postclypeus rather strongly inflated, Pcl/W, 0·31–0·34. Pcl/R_1, 2·47–2·67. Apical teeth of mandibles short, L_A/L_1, 0·59–0·64, R_A/R_1, 0·78–0·82; subsidiary marginal tooth of left mandible separated from molar plate by distinct notch in surface view, complex ratio, $L_A/L_1.L_m$, 12·20–13·49; point of first marginal tooth of right mandible slightly behind line of apical to second marginal, anterior edges of marginal teeth equal in length, $R_A/R_1.R_m$, 15·12–18·60. Fore tibia scarcely swollen, T_1/T_w, 4·51–4·73, third apical spur about one-third length of other two, pale and inconspicuous Mesenteric overlap with proctodeum rather short, less than three times as long as width of mesenteron at insertion of malpighian tubules; enteric valve seating with two very weakly developed opposed lobes and a very small third inner lobe, connected to second pouch of proctodeum by a short neck; lateral in position in unopened abdomen; internal cushions of enteric valve all retracted, about equally developed, with scaly surface only; membranous wall of valve between and beyond cushions with sparse minute spicules.

Measurements (three specimens from separate nest series) in millimetres.

	Range	Mean
Head width (W)	0·74–0·78	0·761
Fore tibia width (T_w)	0·11–0·12	—
Fore tibia length (T_1)	0·51–0·54	0·525
Postclypeus length (Pcl)	0·24–0·25	0·244
Left mandible, apical to first marginal (L_A)	0·07–0·08	0·075
Left mandible, first to third marginal (L_1)	0·12–0·13	0·123
Left mandible, third marginal to molar (L_m)	0·04–0·05	0·048
Right mandible, apical to first marginal (R_A)	0·07–0·08	0·076
Right mandible, first to second marginal (R_1)	0·09–0·10	0·095
Right mandible, second marginal to molar (R_m)	0·04–0·05	0·048

A. improelatans has already been compared with all those preceding it alphabetically. It is easily recognized by its rather wider meso- and metanotal constrictions in the imago and its shorter mixed segment in the worker, quite apart from the different proportions of the mandibles in both castes. The remaining two species of the genus, *A. nanus* and *A. polyscolus*, are both smaller, with rather flattened compound eyes in the imago. In the worker caste, both have spiny armature in the enteric valve.



Figs 567–582. *Anenteotermes*, imago head capsule, front and side views, and imago mandibles. 567–570, *A. improcinctus*; 571–574, *A. nanus*; 575–578, *A. cnaphorus*; 579–582, *A. polyscolus*.

Holotype ♀ imago, paratype ♂ and ♀ imagos, and workers from type-colony, KENYA: 9 m. from Londiani on Kisumu Road, alt. over 7,000 ft, 19.ii.1964 (*R. M. C. Williams* Coll. No. RW9) in British Museum (Natural History).

Other paratype material. KENYA: Kaptagat, 3.iv.1952 (*W. V. Harris*); same data (*W. A. Sands*) also in BMNH.

The species has been recorded from the mounds of *Cubitermes* and *Odontotermes* only at high altitudes in montane grassland.

Anenteotermes nanus (Sjöstedt) comb. n.

(Text-figs 571–574 & 589–594; Pl. 8, fig. 2)

Eutermes nanus Sjöstedt, 1911 : 161. LECTOTYPE ♀, DEMOCRATIC REPUBLIC OF CONGO: Mukimbungu (Naturhistoriska Riksmuseum, Stockholm) here designated [examined].

Imago. Head capsule (colours probably somewhat faded) brown, not appreciably darker above ocelli; fontanelle very small oval, flat, slightly paler than head; medial spot oval, about equal in size to fontanelle, slightly raised on small bump, coloured as head; postclypeus a little paler than head, labrum yellow, frontal marks flat crescents, coloured as head; antennae pale yellow-brown. Pronotum, meso- and metanota pale brown, transverse sutures present; femora and tibiae yellow, tarsi pale yellow. Abdominal tergites pale brown, dorsal stigmata paler, sternites and ventral stigmata very pale brown; cerci yellow.

Posterior margin of head capsule more or less evenly rounded; ocelli medium-sized, separated from compound eyes by slightly more than half up to nearly own least diameter; postclypeus moderately inflated, Pcl/W, 0·29–0·32, posterior margin evenly rounded, median suture present, weak in some specimens. Apical teeth of mandibles moderately long, L_A/L_1, 0·67–0·76, R_A/R_1, 0·84–1·00; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 13·20–15·92; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal shorter than that of second, complex ratio, $R_1/R_A.R_m$ (note difference from ratio used in worker caste), 21·1–23·9. Pilosity of head capsule fairly even, forming a slightly rough pelt with emergent setae, brown.

Measurements (three specimens from two localities) in millimetres.

	Range	Mean
Head width across eyes (W)	0·65–0·69	0·670
Ocellus ($O_w \times O_l$)	0·05–0·06 × 0·08–0·09	0·055 × 0·085
Ocellus to eye (O–E)	0·03–0·05	0·040
Postclypeus length (Pcl)	0·19–0·21	0·202
Antennal article III	0·02	—
Antennal article IV	0·02–0·03	0·024
Antennal article V	0·02–0·04	0·028
Left mandible, apical to first marginal (L_A)	0·06–0·07	0·066
Left mandible, first to third marginal (L_1)	0·09–0·10	0·092
Left mandible, third marginal to molar (L_m)	0·05	—
Right mandible, apical to first marginal (R_A)	0·07	0·066
Right mandible, first to second marginal (R_1)	0·07–0·08	0·074

Right mandible, second marginal to molar (R_m)	0·05	—
Mesonotum width (M)	0·14–0·16	0·146
Metanotum width (N)	0·15–0·16	0·157

Worker. Head capsule and pilosity pale yellow, setae sparse. Postclypeus moderately inflated, Pcl/W, 0·27–0·31, Pcl/R_l, 2·20–2·75. Apical teeth of mandibles fairly long, L_A/L_l, 0·69–0·73, R_A/R_l, 0·82–0·88; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 14·81–16·20; point of first marginal tooth of right mandible, distinctly behind line of apical to second marginal, anterior edge of first marginal much shorter than that of second, $R_A/R_l.R_m$, 20·50–20·70. Fore tibia moderately swollen, T_l/T_w, 3·61–3·78, third apical spur about half length of other two. Mesenteric overlap with proctodeum rather more than four times as long as width of mesenteron at insertion of malpighian tubules; enteric valve seating sessile on second pouch of proctodeum, without a neck, very weakly two-lobed, dorsolateral in position in unopened abdomen; internal cushions of enteric valve all more or less equally developed, protruding slightly through valve opening, surface scaly, scales in posterior one-third of length of cushion developed into small to pronounced spines; membranous wall of valve between and beyond cushions with rather numerous minute spicules.

Measurements (two specimens from separate localities) in millimetres.

Head width (W)	0·56
Fore tibia width (T_w)	0·10
Fore tibia length (T_l)	0·38
Postclypeus length (Pcl)	0·15–0·18
Left mandible, apical to first marginal (L_A)	0·06
Left mandible, first to third marginal (L_l)	0·08
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A)	0·06
Right mandible, first to second marginal (R_l)	0·06–0·07
Right mandible, second marginal to molar (R_m)	0·04

The smallest species of the genus, *A. nanus* has already been compared with all the remaining members other than *A. polyscolus.* The latter species has longer apical mandibular teeth in both castes, a more conspicuous fontanelle in the imago and in the worker, the fully developed enteric valve armature with cushion position 3 elongated and armed with long pectinate spines. The abdomen of the worker caste appears to be dehiscent in *A. nanus.*

A lectotype is designated below from among the existing syntype material of *A. nanus* (Sjöstedt).

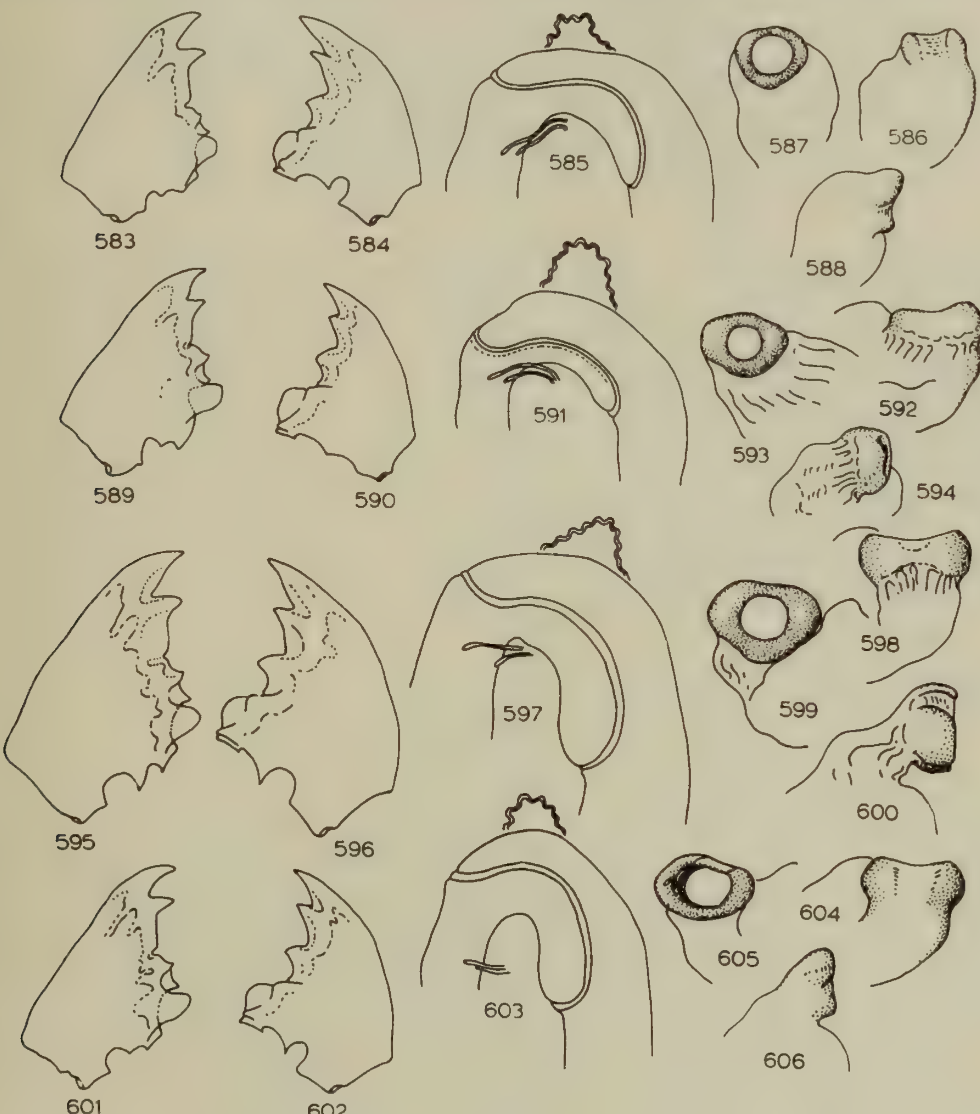
Type-material. *Eutermes nanus* Sjöstedt, LECTOTYPE ♀ imago, paralectotype ♂ and ♀ imagos, and workers from type-colony, DEMOCRATIC REPUBLIC OF CONGO: Mukumungu, ix.1904 (*K. E. Laman*), in Naturhistoriska Riksmuseum, Stockholm; other paralectotypes in AMNH.

Other material. DEMOCRATIC REPUBLIC OF CONGO: Camp Putnam, Epulu River, 17.v.1948 (*A. E. Emerson*) in AMNH.

Anenteotermes polyscolus sp. n.

(Text-figs 566, 579–582 & 601–606; Pl. 8, figs 4–6)

Imago. Head capsule sepia-brown, darker above ocelli; fontanelle oval to elongate oval, slightly smaller than ocellus, slightly depressed, yellow; medial spot oval, flat, smaller than fontanelle, coloured as head; postclypeus brown, labrum yellow-brown; frontal marks flat



FIGS 583–606. *Anenteotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seatings. 583–588, *A. improcinctus*; 589–594, *A. nanus*; 595–600, *A. cnaphorus*; 601–606, *A. polyscolus*.

brown crescents; antennae yellow. Pronotum brown, meso- and metanota yellow-brown, transverse sutures present, weak in some specimens; femora and tibiae yellow, tarsi paler. Abdominal tergites brown, dorsal stigmata sometimes slightly darker, lateral parts of sternites and ventral stigmata brown, sternites yellow in middle; cerci pale yellow.

Posterior margin of head capsule evenly rounded; ocelli rather small, separated from compound eyes by one-third, up to four-fifths own least diameter; postclypeus weakly to moderately inflated, Pcl/W, 0·23–0·31, posterior margin arched or slightly bowed, not evenly rounded, median suture usually distinct. Apical teeth of mandibles short, L_A/L_1, 0·42–0·57, R_A/R_1, 0·63–0·74; subsidiary marginal tooth of left mandible just clear of molar prominence in surface view, complex ratio, $L_A/L_1.L_m$, 8·00–9·30; apical and marginal teeth of right mandible approximately in line, anterior edges of first and second marginal teeth equal in length, complex ratio, $R_1/R_A.R_m$ (note difference from ratio used in worker caste), 21·7–29·9. Pilosity of head capsule pale yellow, a short fine pelt with emergent setae in most specimens, less even in some.

Measurements (10 specimens from six localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	0·69–0·79	0·745 ± 0·030
Ocellus ($O_w \times O_1$)	0·06–0·08 × 0·08–0·10	0·066 ± 0·007 × 0·087 ± 0·009
Ocellus to eye (O–E)	0·02–0·05	0·041 ± 0·008
Postclypeus length (Pcl)	0·17–0·24	0·196 ± 0·025
Antennal article III	0·01–0·03	0·021 ± 0·006
Antennal article IV	0·03–0·05	0·036 ± 0·006
Antennal article V	0·03–0·04	0·036 ± 0·006
Left mandible, apical to first marginal (L_A)	0·05–0·07	0·060 ± 0·007
Left mandible, first to third marginal (L_1)	0·10–0·13	0·124 ± 0·005
Left mandible, third marginal to molar (L_m)	0·05–0·06	0·055 ± 0·006
Right mandible, apical to first marginal (R_A)	0·06–0·07	0·063 ± 0·005
Right mandible, first to second marginal (R_1)	0·09–0·10	0·092 ± 0·005
Right mandible, second marginal to molar (R_m)	0·05–0·06	0·056 ± 0·004
Mesonotum width (M)	0·16–0·20	0·173 ± 0·011
Metanotum width (N)	0·16–0·20	0·175 ± 0·014

Worker. Head capsule pale yellow, pilosity sparse, yellow. Postclypeus moderately to strongly inflated, Pcl/W, 0·28–0·35, Pcl/R_1, 2·30–3·02. Apical teeth of mandibles short, L_A/L_1, 0·50–0·60, R_A/R_1, 0·68–0·80; subsidiary marginal tooth of left mandible separated from molar prominence by distinct notch in surface view, complex ratio, $L_A/L_1.L_m$, 12·52–14·60; point of first marginal tooth of right mandible distinctly behind line of apical to second marginal, anterior edge of first marginal distinctly shorter than that of second, $R_A/R_1.R_m$, 16·60–18·30. Fore tibia moderately swollen, T_1/T_w, 3·58–4·05, third apical spur small, but not vestigial, about one-quarter length of other two. Mesenteric overlap with proctodeum from four to five and a half times as long as width of mesenteron at insertion of malpighian tubules; enteric valve seating very weakly two-lobed, connected to second pouch of proctodeum by a very short neck, lateral in position in unopened abdomen; internal cushions of enteric valve in positions 1 and 2 retracted, very small, with scaly surface on at most one or two small spines; position 3 produced through valve opening, cylindrical, tapering distally and armed with 10–15 elongated pectinate spines around the edge, and other prominent spines on the posterior ends of scales on the proximal part of the cushion; position 4 retracted, similar in size to position 2,

with scaly surface and one or two small spines; membranous wall of valve between and beyond cushions with sparse minute spicules.

Measurements (five specimens from separate localities) in millimetres.

	Range	Mean ± S.D.
Head width (W)	0·60–0·64	0·621 ± 0·081
Fore tibia width (T_w)	0·11–0·12	0·111 ± 0·006
Fore tibia length (T_l)	0·43–0·45	0·433 ± 0·011
Postclypeus length (Pcl)	0·17–0·22	0·186 ± 0·020
Left mandible, apical to first marginal (L_A)	0·05–0·06	0·053 ± 0·005
Left mandible, first to third marginal (L_l)	0·10	—
Left mandible, third marginal to molar (L_m)	0·04	—
Right mandible, apical to first marginal (R_A)	0·05–0·06	0·054 ± 0·003
Right mandible, first to second marginal (R_l)	0·07–0·08	0·054 ± 0·003
Right mandible, second marginal to molar (R_m)	0·04	—

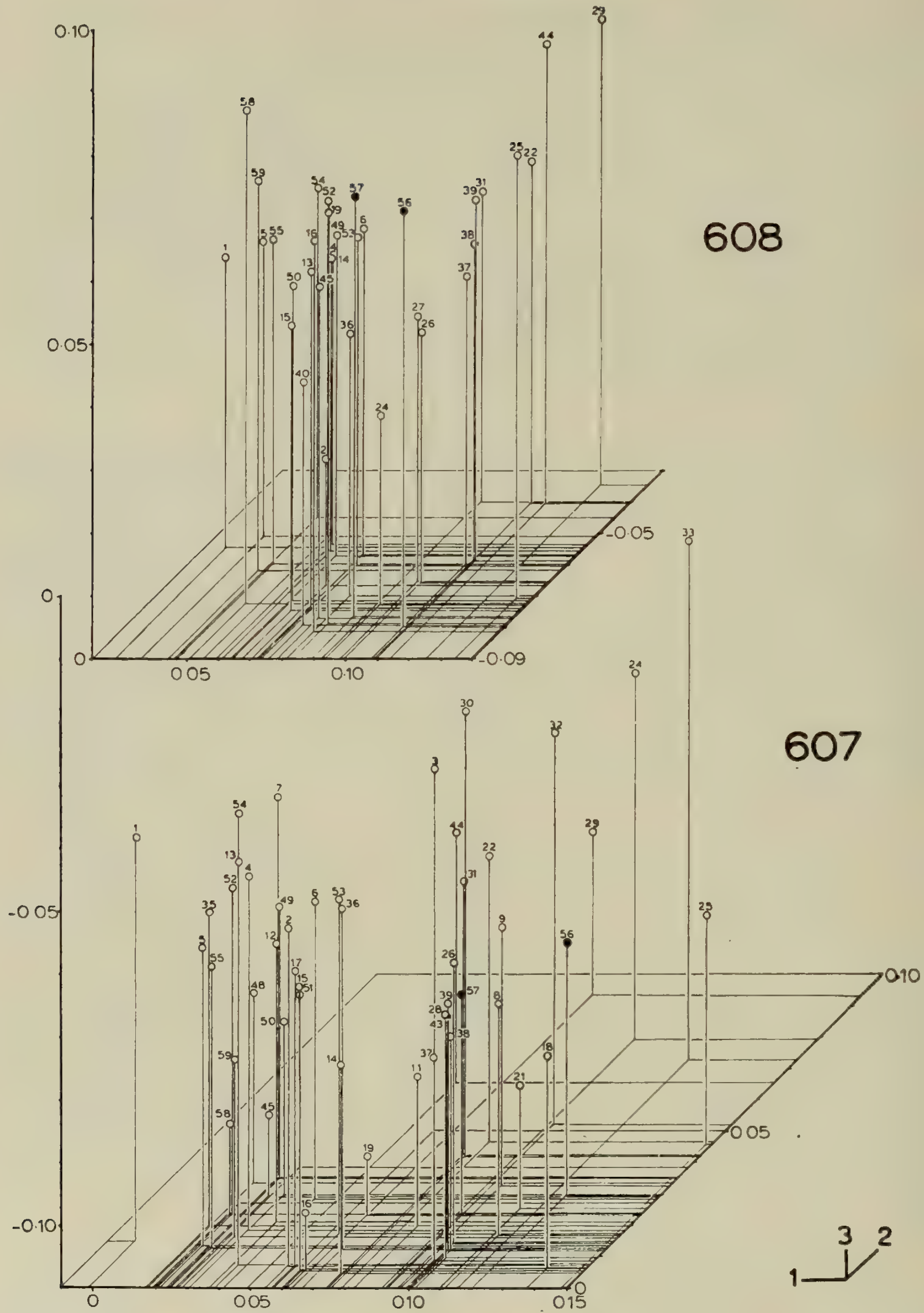
A. polyscolus has already been compared with the other members of the genus under their own descriptions. The abdomen of the worker caste is probably dehiscent, though few specimens show clear signs of this in the preserved material.

There is a fair amount of variation in the enteric valve armature, the imago head pilosity and fontanelle, and even in the proportions of the mandibular teeth, among the specimens included in this species. It may well be that when more material is found it will be necessary to divide it into an eastern and a western species. However, the differences observed in the existing specimens are not clear enough to justify separation at present. One or two specimens are outliers in some dimensions of the principal component analysis (Text-fig. 566) almost as distant from the main clump as those of *A. cnaphorus*. This is largely a reflection of the mandible variation mentioned above.

Holotype ♀ imago, paratype ♂ and ♀ imagos and workers from type-colony, GHANA: 10 m. N. of Wenchi on Bamboi Road, 30.iii.1959 (*W. A. Sands* Coll., No. S.2689), in British Museum (Natural History).

Other paratype material. GHANA: 5½ m. from Dunkwa on Obuasi Road, 4.iv.1959 (*W. A. Sands*); Aburi, 1926 (*W. H. Patterson*). IVORY COAST: Youhouli, 10 km N. of Dabou, 13.v.1963 and 'Basse Cote D'Ivoire' (*P. Bodot*). SIERRA LEONE: Freetown, 8.i.1958 (*W. Wilkinson*). GUINEA: Mount Nimba, Route de Keoulenta, x.1951 (*M. Lamotte*) in AMNH. NIGERIA: Northern Region, Fan, near Forum, Jos plateau, 25.vii.1957, 3 m. from Ankpa on Dekina Road, 6.iii.1958; Western Region, 27 m. S. of Ilorin on Oyo Road, 4.xii.1957 and between Shagamu and Ijebu-Ode, 14.xii.1957 (*W. A. Sands*); Eastern Region, 40 m. from Port Harcourt on Owerri Road, 19.iii.1957 (*W. Wilkinson*). CAMEROUN: Mamfe, 27.v.1957 (*W. Wilkinson*). DEMOCRATIC REPUBLIC OF CONGO: Stanleyville, 26.v.1948 (*A. Emerson*), in AMNH.

All material is in the British Museum (Natural History) unless otherwise stated. Fourteen nest-series have been examined. Most of the records are from the mounds of other species, either *Cubitermes*, *Procubitermes* or *Macrotermes*. Some are from loose soil near tree roots and the habitats range from dense rain forest to Northern Guinean Savanna.



FIGS 607 & 608. Three dimensional graphs of canonical variates 1, 2 & 3 showing species of *Aderitotermes* as solid spots. 607, imago; 608, worker caste.

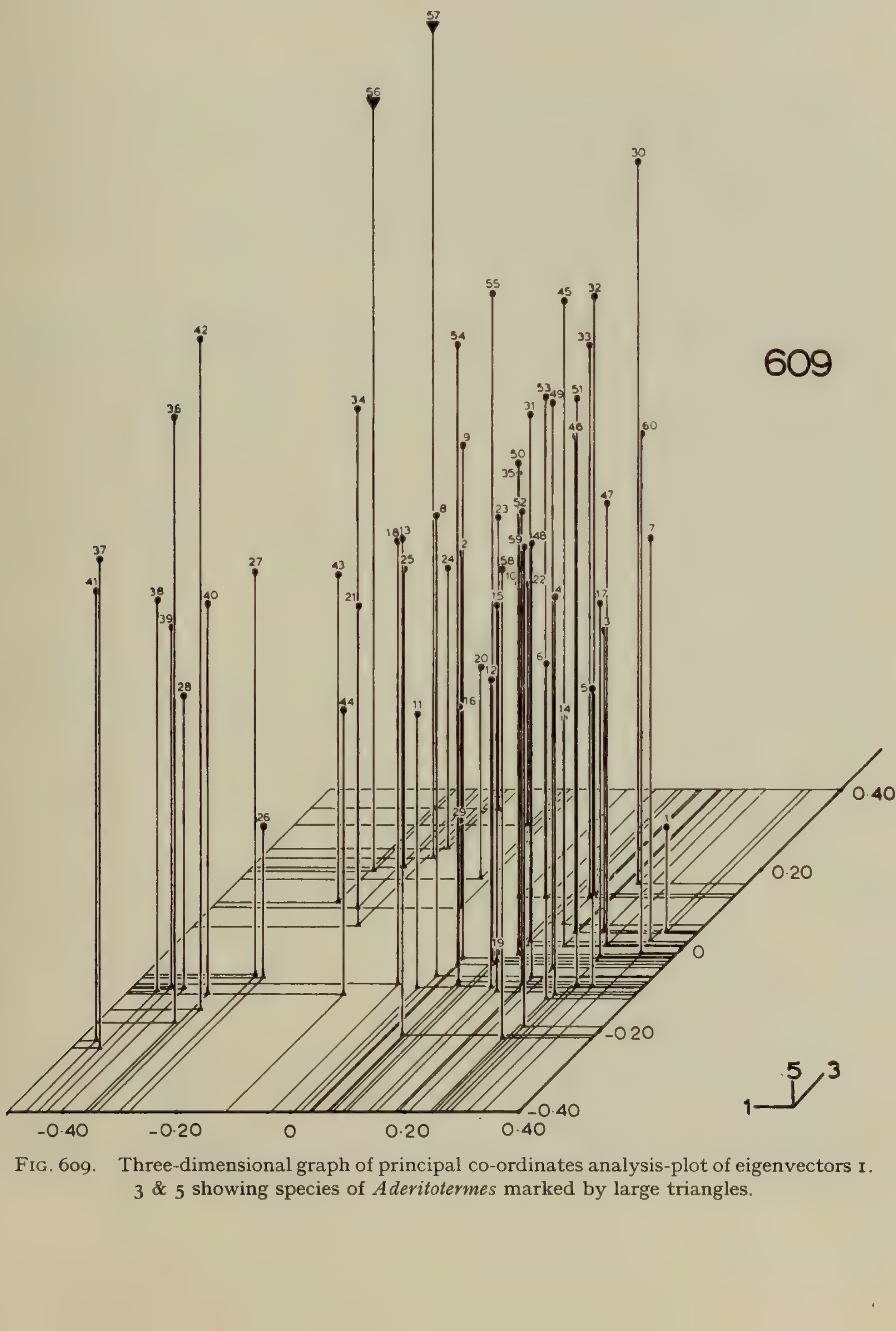


FIG. 609. Three-dimensional graph of principal co-ordinates analysis-plot of eigenvectors 1. 3 & 5 showing species of *Aderitotermes* marked by large triangles.

ADERITOTERMES gen. n.

(Aderitos, Gr., 'without strife')

Type-species: *Aderitotermes fossor* sp. n.

Imago. Large, W, 1·04–1·31. Fore tibia with three apical spurs, third well developed, about two-thirds length of other two. Apical teeth of mandibles fairly short, L_A/L_l, 0·54–0·68, R_A/R_l, 0·73–1·06; subsidiary marginal tooth of left mandibles separated from molar prominence by a distinct notch in surface view, $L_A/L_l.L_m$. Right mandible with points of apical and marginal teeth approximately in line, anterior edges of first and second marginals equal in length. Fontanelle circular to short oval, distinct, conspicuously paler than head capsule. Pilosity of head a short, fine, even silvery pelt, with emergent setae. Meso- and metanota fairly wide at constrictions, M/W, 0·28–0·34, transverse dark sutures present; complex ratio of mandible and notal measurements, L_l/M.N, 1·26–2·05.

Worker. Large, W, 0·90–0·99. Fore tibia weakly to scarcely swollen, T_l/T_w, 4·21–5·31, with three apical spurs, third about half length of other two. Apical teeth of mandibles fairly short to moderately long, L_A/L_l, 0·60–0·79, R_A/R_l, 0·78–1·00; subsidiary marginal tooth of left mandible separated from molar prominence by a distinct notch in surface view, complex ratio, $L_A/L_l.L_m$, 11·69–14·10. Right mandible with point of first marginal tooth slightly behind line of apical to second marginal, anterior edges of marginal teeth equal in length, complex ratio, $R_A/R_l.R_m$, 13·80–17·45. Mesenteric junction with proctodeum overlapping, elongated to form a distinct mixed segment, four to five times as long as width of mesenteron at insertion of malpighian tubules, proximal end of proctodeum well to left of malpighian knot. Enteric valve seating with three prominent equal lobes, regularly spaced, connected to second pouch of proctodeum by distinct to very elongated neck, fully dorsal in position in unopened abdomen; internal cushions of enteric valve retracted, or produced distally through valve opening, not sclerotized, scales on cushion surfaces, and membranous wall of valve between and beyond cushions fringed with minute to prominent spicules.

This genus is fairly readily recognized in the imago by the conspicuous fontanelle, combined with the very short, fine, even silvery pilosity of the head capsule and the large size. The only sympatric species with superficial similarity is *Astratotermes prosenus*, and this is larger with uneven pilosity. In the worker caste, the elongated mixed segment distinguishes *Aderitotermes* from most other genera. Of the two genera with this feature similarly developed, *Adaiphrotermes* has a swollen end to the mesenteron, and only two apical spurs on the fore tibia. *Anenteotermes* is smaller, and the enteric valve seating and armature is different.

Aderitotermes is one of the more isolated genera in the analyses of the similarity matrix. In both single linkage clustering and median sorting it lies adjacent to *Amicotermes*, which is reflected on the first five of the principal co-ordinates other than the second (Text-fig. 609). The similarity of the enteric valve armature between those genera may result from a genuine relationship. *Amicotermes* has no mixed segment and longer mandibular apical teeth, being more primitive in the former and more specialized in the latter character.

The two species of *Aderitotermes* described here resemble each other very closely in every feature except the enteric valve armature. The latter character is so widely different as to appear unrelated, had not a third species been discovered that exactly bridges the gap. Unfortunately the imago of the third species is unknown, and so it remains undescribed at present. However, its enteric valve is illustrated in Pl. 9, fig. 5, because of the phylogenetic interest of its intermediate structure. The

dimensional similarity of the two species is illustrated by their closeness in the plots of canonical variates (Text-figs 607 and 608) and of principal component scores (Text-fig. 610). The abdomen of the worker caste is dehiscent throughout the genus.

Keys to Species

Imagos

1 Postclypeus slightly less inflated, Pcl/R_A, 1·82–2·45; complex ratio of mandible and notal measurements $L_l/M.N$, 1·26–1·52. Abdominal stigmata usually paler than surrounding tergites and sternites. (Distribution, W. Africa, Nigeria to Gambia) ***cavator*** (p. 224)

– Postclypeus slightly more inflated, Pcl/R_A, 2·37–3·00; complex ratio $L_l/M.N$, 1·50–2·05. Abdominal stigmata usually darker than surrounding sclerites. (Distribution, E. African, Uganda to N.E. Tanzania) . . . . ***fossor*** (p. 226)

Workers

1 Enteric valve with internal cushions retracted, distal ends armed with numerous prominent but fine spicules, and similar spicules on smooth membranous wall of valve between and beyond cushions; proximal parts of cushions smooth and

FIG. 610. *Aderitotermes*, distinction between *A. cavator* (rings) and *A. fossor* (spots). Plots of principal component scores (transformed variables) corresponding to first to fourth latent roots of correlation matrices of worker and imago, first and second of both castes combined, and fifth of imago alone. Only on the fifth was there clear separation of imagos. The largest weighting coefficients of the fifth eigenvector attached to the meso- and metanotal widths, providing the complex discriminant ratio $L_l/M.N$ used in the key.

unarmed. Apical teeth of mandibles shorter, L_A/L_1, 0·60–0·64, R_A/R_1, 0·78–0·88. Fore tibia slightly swollen, T_1/T_w, 4·21–4·62 . . . . . . ***fossor*** (p. 226)

– Enteric valve with cushions produced through valve opening as flattened vanes, surface scaly, each scale fringed with minute spicules and a few small spines; membranous wall of valve between and beyond cushions caruncled, each lobe fringed distally with minute spicules. Apical teeth of mandibles longer, L_A/L_1, 0·64–0·79, R_A/R_1, 0·88–1·00. Fore tibia scarcely swollen, T_1/T_m, 5·08–5·31 ***cavator*** (p. 224)

Aderitotermes cavator sp. n.

(Text-figs 610, 611–614 & 619–624; Pl. 9, figs 6–9)

Imago. Head capsule dark sepia-brown, darker above ocelli, dark areas sometimes extending as streaks tapering towards fontanelle; fontanelle circular or very short oval, flat or slightly depressed, smaller than ocellus, yellow-white to yellow-brown, conspicuous; medial spot circular, flat, smaller than fontanelle, sepia-brown; postclypeus brown, labrum yellow-brown; frontal marks flat brown crescents; antennae yellow-brown; pronotum sepia-brown, meso- and metanota brown; femora pale yellow-brown, tibiae yellow, tarsi paler. Abdominal tergites sepia-brown, dorsal stigmata paler, sternites brown, yellow in middle, ventral stigmata pale brown; cerci pale yellow.

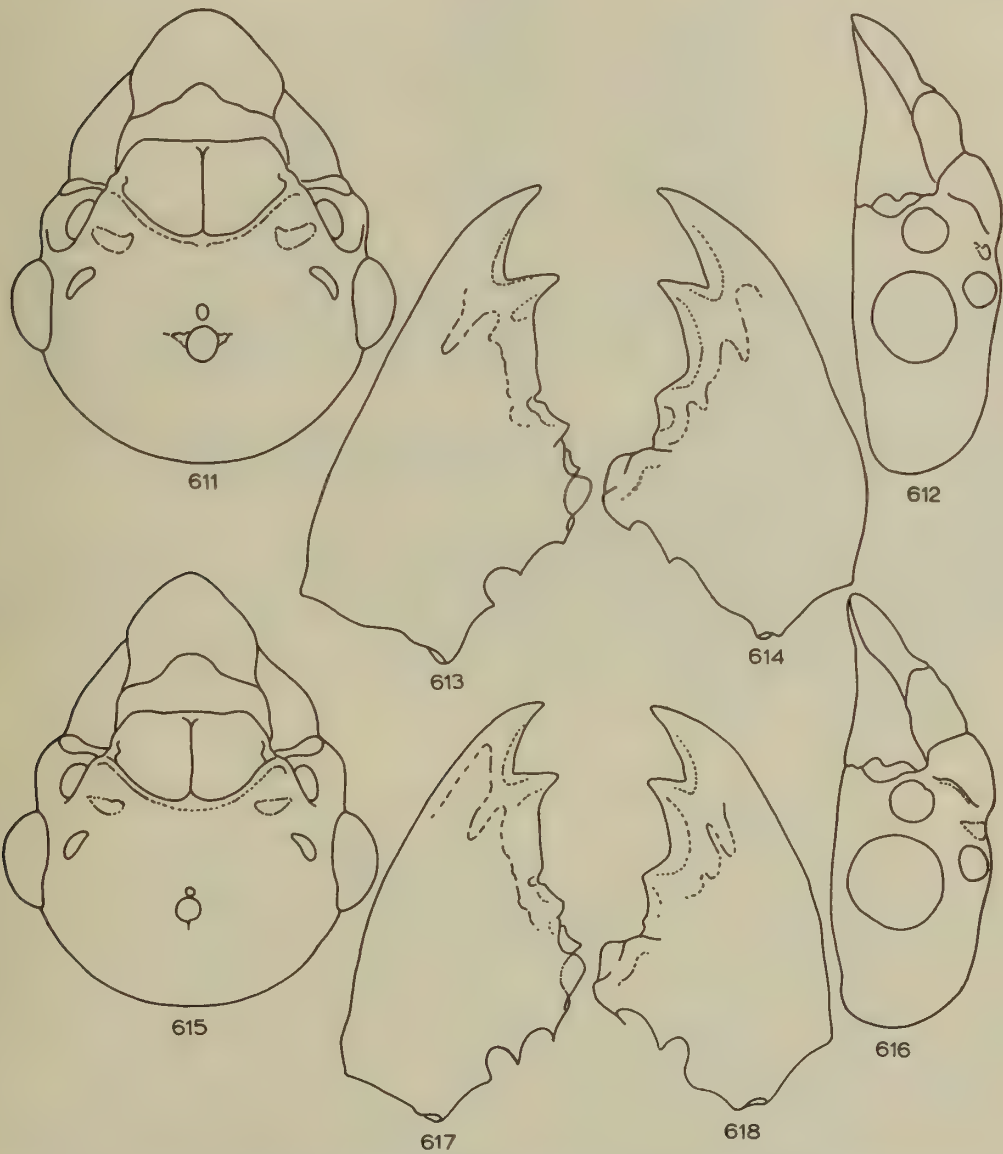
Posterior margin of head capsule usually slightly undulating not quite evenly rounded, but some specimens evenly rounded; ocelli fairly large, separated from compound eyes by half own least diameter or more; postclypeus weakly to moderately inflated, Pcl/W, 0·21–0·27, Pcl/R_A, 1·82–2·45, posterior margin arched or evenly rounded, median suture present, sometimes weak. Characters of mandibles and head pilosity given in generic diagnosis. Complex ratio of mandible and notal measurements L_1/M.N, 1·26–1·52.

Measurements (nine specimens from five localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W) .	1·09–1·31	1·213 ± 0·072
Ocellus ($O_w \times O_l$) . . .	0·09–0·13 × 0·12–0·18	0·098 ± 0·011 × 0·137 ± 0·019
Ocellus to eye (O–E) . .	0·05–0·09	0·070 ± 0·013
Postclypeus length (Pcl) .	0·25–0·33	0·293 ± 0·030
Antennal article III . .	0·04–0·07	0·050 ± 0·011
Antennal article IV . .	0·05–0·06	0·058 ± 0·007
Antennal article V . .	0·05–0·07	0·060 ± 0·008
Left mandible, apical to first marginal (L_A)	0·09–0·14	0·125 ± 0·014
Left mandible, first to third marginal (L_1)	0·17–0·24	0·200 ± 0·019
Left mandible, third marginal to molar (L_m)	0·07–0·09	0·081 ± 0·006
Right mandible, apical to first marginal (R_A)	0·11–0·15	0·131 ± 0·013
Right mandible, first to second marginal (R_1)	0·14–0·18	0·150 ± 0·016
Right mandible, second marginal to molar (R_m) . .	0·07–0·09	0·081 ± 0·009
Mesonotum width (M) . .	0·35–0·42	0·386 ± 0·027
Metanotum width (N) . .	0·38–0·44	0·397 ± 0·023

Worker. Head capsule yellow-white, pilosity pale yellow, very sparse. Postclypeus moderately inflated, Pcl/W, 0·26–0·28, Pcl/R_1, 2·38–2·44. Apical teeth of mandibles rather long, L_A/L_1, 0·64–0·79, R_A/R_1, 0·88–1·00. Fore tibia scarcely swollen, T_1/T_w, 5·08–5·31. Enteric

valve seating connected to second pouch of proctodeum by a very distinct neck of moderate length; internal cushions of enteric valve all produced through valve opening as flattened vanes, their surfaces reticulated or scaly, posterior margin of each scale fringed with minute spicules and one or two small spines; membranous wall of valve between and beyond cushions carunculated, each lobe fringed posteriorly with very numerous minute spicules. Other characters of mandibles and intestine given in generic diagnosis.



FIGS 611–618. *Aderitotermes*, imago head capsules, front and side views, and imago mandibles. 611–614, *A. cavator*; 615–618, *A. fossor*.

Measurements (two specimens from separate localities) in millimetres.

Head width (W)	0·98–0·99
Fore tibia width (T_w)	0·15–0·16
Fore tibia length (T_l)	0·76–0·86
Postclypeus length (Pcl)	0·25–0·28
Left mandible, apical to first marginal (L_A)	0·09–0·12
Left mandible, apical to third marginal (L_l)	0·15–0·17
Left mandible, third marginal to molar (L_m)	0·06–0·07
Right mandible, apical to first marginal (R_A)	0·09–0·11
Right mandible, first to second marginal (R_l)	0·11–0·13
Right mandible, second marginal to molar (R_m)	0·06–0·08

A. cavator is the more specialized of the two described species, and the third known species is intermediate in form between *A. cavator* and the type-species of the genus, *A. fossor*. The longer apical teeth of the mandibles, and the vaned enteric valve armature are characteristic.

Holotype ♀ (queen), paratype ♂ (king) and workers from type-colony, NIGERIA: Northern Region, Samaru, near Zaria, xii.1958 (*W. A. Sands* coll., No. S.2142) in British Museum (Natural History).

Other paratype material. NIGERIA: Northern Region: 30 m. from Lokoja, on Okene Road, 8.iii.1958, Samaru, 18.v.1959 (*W. A. Sands*); Eastern Region, Port Harcourt, 19.x.1957 (*W. Wilkinson*). IVORY COAST: Mount Nimba, Yale, 14.iv.1968 (*G. Josens*). GAMBIA: Nyambai, 16°40′W., 13°18′N., 13.ix.1966 and between Sanyang and Gunjur, 16°46′W., 13°15′N., 16.ix.1966 (*W. A. Sands*).

This species was recorded from soil, the foot of trees, and *Macrotermes* mounds.

Aderitotermes fossor sp. n.

(Text-figs 610, 615–618 & 625–630; Pl. 9, figs 1–4)

Imago. Head capsule sepia-brown or tinged with reddish towards chestnut-brown, darker above ocelli, dark areas sometimes extending as streaks towards fontanelle; fontanelle circular, flat, about half as large as ocellus, yellow-white, very conspicuous; medial spot oval, flat, smaller than fontanelle, coloured as head; postclypeus brown, labrum yellow-brown; frontal marks weakly developed flat crescents, coloured as head or slightly paler; antennae pale yellow-brown. Pronotum sepia-brown, meso- and metanota brown; femora pale yellow-brown, tibiae and tarsi paler. Abdominal tergites brown, dorsal stigmata dark sepia-brown, sternites pale brown, yellow in middle, ventral stigmata brown; cerci yellow.

Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by half own least diameter or more; postclypeus weakly to moderately inflated, Pcl/W, 0·24–0·30, Pcl/R_A, 2·37–3·00, posterior margin evenly rounded, median suture distinct, characters of mandibles and head pilosity given in generic diagnosis. Complex ratio of mandible and notal measurements, L_l/M.N, 1·50–2·05.

Measurements (eight specimens from four localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	1·04–1·21	1·125 ± 0·055
Ocellus ($O_w \times O_l$)	0·08–0·10 × 0·10–0·13	0·091 ± 0·009 × 0·118 ± 0·011
Ocellus to eye (O–E)	0·05–0·08	0·064 ± 0·010
Postclypeus length (Pcl)	0·27–0·34	0·291 ± 0·022
Antennal article III	0·03–0·06	0·044 ± 0·008
Antennal article IV	0·04–0·06	0·051 ± 0·006
Antennal article V	0·04–0·06	0·049 ± 0·005
Left mandible, apical to first marginal (L_A)	0·10–0·11	0·106 ± 0·005
Left mandible, first to third marginal (L_l)	0·18–0·19	0·182 ± 0·007
Left mandible, third marginal to molar (L_m)	0·06–0·08	0·076 ± 0·006
Right mandible, apical to first marginal (R_A)	0·10–0·12	0·110 ± 0·005
Right mandible, first to second marginal (R_l)	0·13–0·14	0·136 ± 0·006
Right mandible, second marginal to molar (R_m)	0·06–0·09	0·078 ± 0·008
Mesonotum width (M)	0·29–0·35	0·326 ± 0·022
Metanotum width (N)	0·30–0·36	0·334 ± 0·022

Worker. Head capsule yellow-white, pilosity pale yellow, very sparse. Postclypeus moderately inflated, Pcl/W, 0·25–0·27, Pcl/R_l, 2·22–2·35. Apical teeth of mandibles short, L_A/L_l, 0·60–0·64, R_A/R_l, 0·78–0·88. Fore tibia slightly swollen, T_l/T_w, 4·21–4·62. Enteric valve seating connected to second pouch of proctodeum by very long neck; internal cushions of enteric valve all retracted, equally developed, armed at posterior ends with numerous long, prominent but fine spicules, rest of cushions smooth and unarmed; membranous wall of valve between and beyond cushions similarly armed with long spicules forming an entire fringe round valve opening. Other characters of mandibles and intestine given in generic diagnosis.

Measurements (four specimens from four localities) in millimetres.

	Range	Mean
Head width (W)	0·90–0·95	0·916
Fore tibia width (T_w)	—	0·148
Fore tibia length (T_l)	0·63–0·68	0·642
Postclypeus length (Pcl)	0·23–0·25	0·239
Left mandible, apical to first marginal (L_A)	—	0·089
Left mandible, first to third marginal (L_l)	0·14–0·15	0·144
Left mandible, third marginal to molar (L_m)	0·04–0·05	0·048
Right mandible, apical to first marginal (R_A)	—	0·088
Right mandible, first to second marginal (R_l)	0·10–0·11	0·105
Right mandible, second marginal to molar (R_m)	0·05–0·06	0·053

A. fossor was chosen as type-species of the genus *Aderitotermes* because although quite distinct from other genera, it is the most primitive in having shorter apical mandibular teeth, and the enteric valve armature of spicules alone. It shows distinct resemblances to *Amicotermes* in this respect, and it should be noted that a dense fringe of minute spicules is also found in *Acholotermes*. Both these genera have more elongated apical teeth, but the enteric valve seating is similar, and in

A. epius there is a tendency for it to move into a dorsal position accompanied by an elongation of the mesenteric-proctodeal overlap.

Holotype ♀ imago, paratype ♂ and ♀ imagos, and workers from type-colony, UGANDA: Kampala, Makerere, 27.1959 (*A. French*), in British Museum (Natural History).

Other paratype material. UGANDA: Kawanda, v.1949 (*W. V. Harris*); Bubandi, 1952 (*H. A. Osmaston*). KENYA: Kisumu, 15.vii.1940 (*E. E. Haviland*) in AMNH; Kiamosi Forest, Kakamega District, 20.iv.1952 (*W. A. Sands*). TANZANIA: Amani, Lewa, 14.iii.1951 and Ngua, 7.viii.1951 (*P. B. Kemp*). ZAMBIA: Abercorn, iii.1947 (*P. E. Glover*). MALAWI: 9 m. N. of Kota-Kota turnoff on Dowa–Lilongwe Road, 16.ix.1953 (*W. Sands & W. Wilkinson*). All material in British Museum (Natural History) unless otherwise stated.

This species appears to be one in which the alate swarms emerge in daylight, and has several times been collected in the act. It is also recorded walking about above ground level when expelled by doryline ants in the same way as *Alyscotermes kilimandjaricus*. Other records have been from small grassy mounds in forest glades.

FIGS 619–630. *Aderitotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seating. 619–624, *A. cavator*; 625–630, *A. fossor*.

ADAIPHROTERMES gen. n.

(A—'Not', daiphron, Gr., 'warlike')

Type-species: *Adaiphrotermes cuniculator* sp. n.

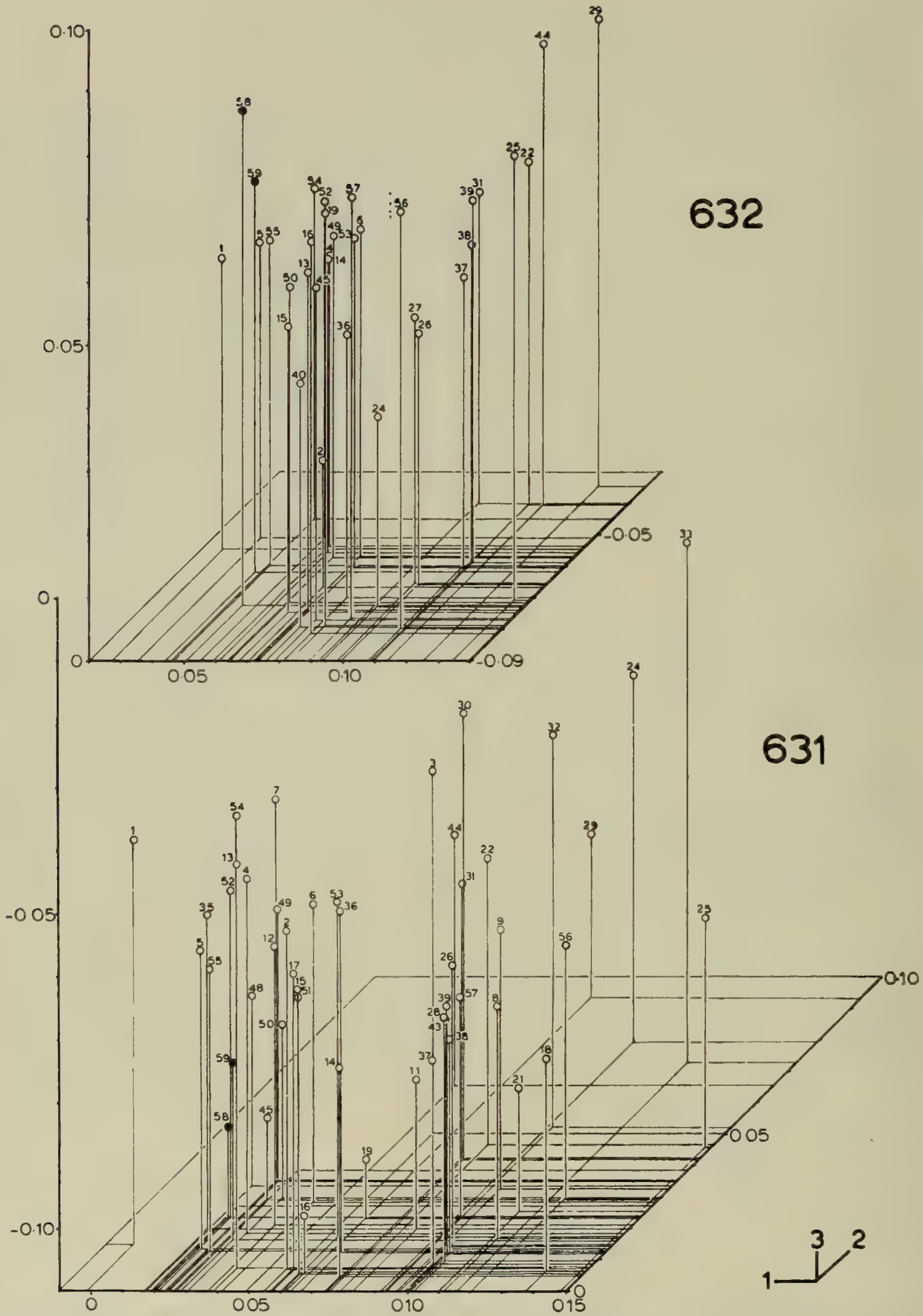
Imago. Small to medium-sized, W, 0·71–1·01. Fore tibia with only two apical spurs. Apical teeth of mandibles short, L_A/L_l, 0·43–0·57, complex ratio, R_A/R_l, 0·66–0·93; subsidiary marginal tooth of left mandible with proximal end, clear of molar prominence in surface view, complex ratio, $L_A/L_l.L_m$, 5·96–11·10. Right mandible with first and second marginal teeth more or less equal in length and in line with apical tooth. Meso- and metanota narrow at constriction, M/W, 0·16–0·23; mesonotal suture absent, metanotal suture weak or absent.

Worker. Small to medium-sized, W, 0·59–0·75. Fore tibia with only two apical spurs, hairy, with prominent bristles on posterior margin, swollen, T_l/T_w, 3·00–4·00. Apical teeth of mandibles short, L_A/L_l, 0·46–0·64, R_A/R_l, 0·65–1·10; subsidiary marginal tooth of left mandible with proximal end clear of molar prominence, complex ratio, $L_A/L_l.L_m$, 10·1–14·3; apical and marginal teeth of right mandible approximately equal and with their points in line, complex ratio, $R_A/R_l.R_m$, 14·3–20·8. Mixed segment of gut (mesenteric overlap with proctodeum) elongated extending beyond malpighian knot, mesenteron terminating in spherical or hemispherical dilation. First section of proctodeum long, swollen, constricting sharply to narrow tubular enteric valve; valve seating with two or three lobes or a simple rim, sessile on second pouch of proctodeum or with short neck, dorsal in position in unopened abdomen; internal cushions of enteric valve unarmed, reticulate or weakly scaled, mainly towards proximal ends.

The characters given in the above diagnosis make this one of the easiest genera to recognize. No other African genus completely lacks the third apical spur on the fore tibia, and in the worker caste the very characteristic gut with the white mesenteric 'ball' is easily recognizable even in the unopened abdomen. The abdomen of the worker is not dehiscent in this genus. The only other genera with an elongated mixed segment are *Aderitotermes* and *Anenteotermes*, and in these the end of the mesenteron is not dilated. In the multivariate analyses based on measurements, *Adaiphrotermes* stands out more clearly (Text-figs 631 and 632) than in the vector diagram of the similarity analysis (Text-fig. 633), but in all it is close to the large *Astalotermes-Anenteotermes* cluster as previously stated. Outside Africa, the most closely similar genus appears to be the Neotropical *Anoplotermes*, which also has only two apical spurs on the fore tibia, and a closely similar gut. However, the proportions of the apical and marginal teeth of the mandibles are different, and the proximal end of the subsidiary marginal tooth of the left mandible is hidden well behind the molar prominence. This is a feature of most of the more primitive genera of the Oriental region, and of most termites, and is far more important than its relative size would suggest. There is little doubt that the *Anoplotermes* of South America actually comprise several genera as do the African species hitherto also all included in that genus, and that the similarities result from convergence rather than close direct relationship.

Only three species are described in *Adaiphrotermes*, but worker castes alone of several other species are also known. However it is considered undesirable at present to describe them in the absence of their corresponding imago castes.

Adaiphrotermes appears to be the only genus which has definitely been recorded as attacking sound wood, though it is unlikely that this is its main diet. Both *A. choanensis* and *A. scapheutes* have been found on bait pegs in 'graveyard' tests in South Africa and Zambia.



FIGS 631 & 632. Three-dimensional graphs of canonical variates 1, 2, & 3 showing species of *Adaiphrotermes* as solid spots. 631, imago, 632, worker caste.

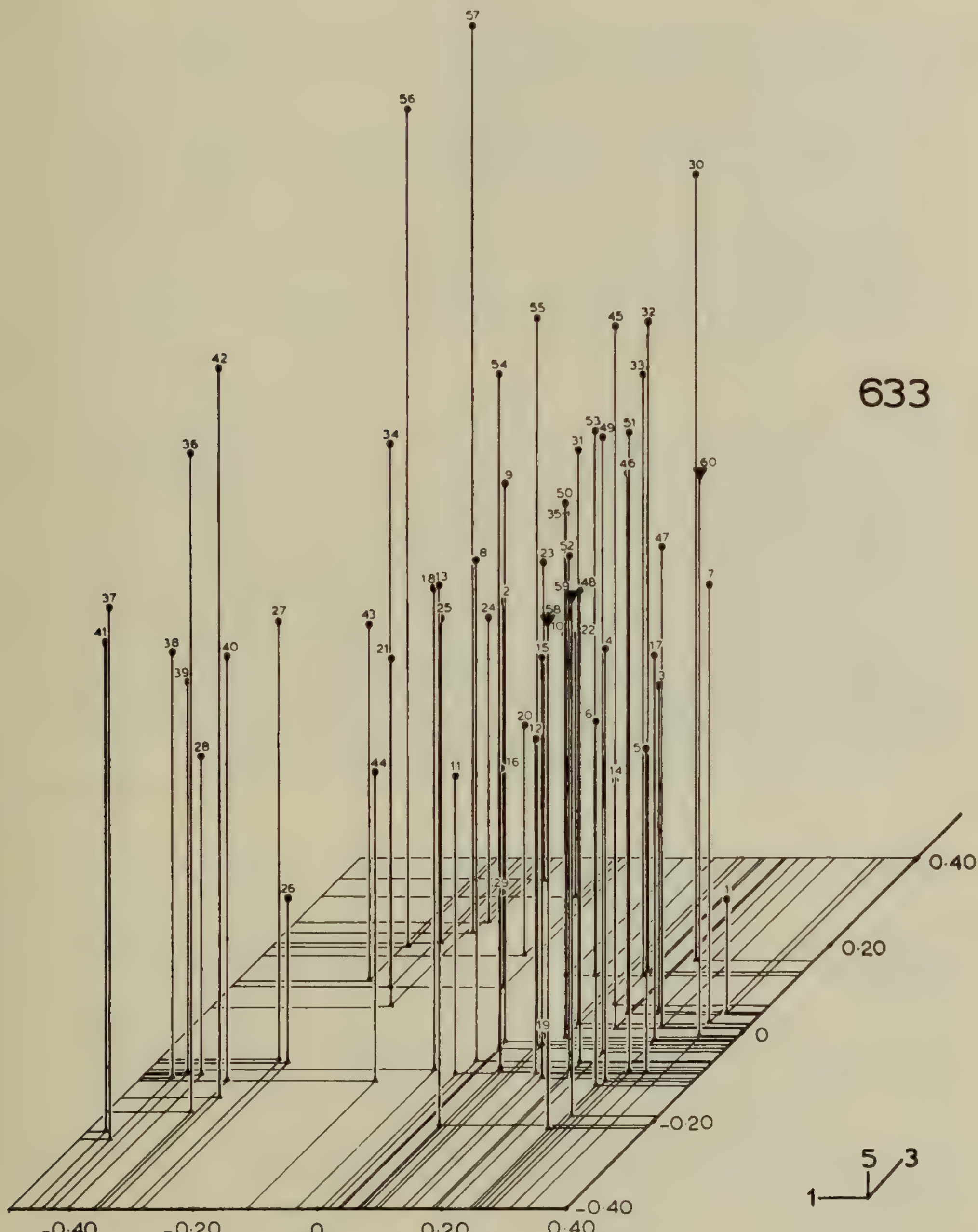


FIG. 633. Three-dimensional graph of principal co-ordinates analysis-plot of eigenvectors 1, 3 & 5 showing species of *Adaiphrotermes* marked by large triangles.

Keys to Species

Imagos

1 Fontanelle small to vestigial, short oval to circular, flat or slightly depressed, equal in size to or smaller than medial spot, distinct and pale coloured to obscure, coloured as head. Larger, W, 0·83–1·01 2
– Fontanelle usually large, oval to elongate oval, pale and sharply distinct from head colour, larger than medial spot and often slightly raised; small specimens, W under 0·80, may have small inconspicuous fontanelle. Distribution, S. Africa to Tanzania . . . . ***choanensis*** (p. 232)
2 Postclypeus moderately to strongly inflated, with evenly rounded posterior margin and distinct median suture, Pcl/R_A, 2·88–3·31; posterior margin of head capsule unevenly rounded (Text-fig. 638) . . . . . . ***cuniculator*** (p. 235)
– Postclypeus strongly inflated with sinuate posterior margin and weak or indistinct median suture, Pcl/R_A, 3·59; posterior margin of head capsule evenly rounded ***scapheutes*** (p. 237)

Workers

1 Length of mixed segment, measured round outside of curve, 3–4 times width of mesenteron at insertion of malpighian tubules . . . ***cuniculator*** (p. 235)
– Length of mixed segment, measured round outside of curve, more than five times width of mesenteron at insertion of malpighian tubules 2
2 Left mandible with proximal end of subsidiary marginal tooth well clear of molar prominence; enteric valve seating with three definite lobes and a short neck connecting it to proctodeal pouch; postclypeus less inflated, Pcl/R_l, 1·59, apical teeth of mandibles shorter, L_A/L_l, 0·46, R_A/R_l, 0·65. Fore tibia more inflated, T_l/T_w, 3·08 . . . . ***scapheutes*** (p. 237)
– Left mandible with proximal end of subsidiary marginal tooth only just clear of molar prominence; enteric valve seating a circular rim or weakly lobed, sessile on proctodeal pouch; postclypeus more inflated, Pcl/R_l, 2·50–3·40; apical teeth of mandibles longer, L_A/L_l, 0·50–0·64, R_A/R_l, 0·70–1·10; fore tibia less inflated, T_l/T_w, 3·52–4·00. (Most of these characters also apply to *cuniculator*.) ***choanensis*** (p. 232)

Adaiphrotermes choanensis (Fuller) **comb. n.**

(Text-figs 634–637 & 646–650; Pl. 9, fig. 10)

Mirotermes (*Procubitermes*) *choanensis* Fuller, 1925 : 184. LECTOTYPE ♀, Republic of South Africa: Pretoria, Arcadia (National Collection of Isoptera, Pretoria) here designated [examined].

Imago. Head capsule varies from sepia-brown to dark sepia-brown, pitch-black above ocelli; fontanelle from very small, circular, slightly depressed and coloured as head, to larger than ocelli, white, swollen, elongate oval; medial spot circular to oval about one-quarter size of ocellus, usually slightly raised; postclypeus sepia-brown, labrum yellow-brown; frontal marks variable, usually distinct, crescent-shaped, without setae, flat; antennae pale brown. Pronotum sepia-brown, meso- and metanota brown, without dark sutures; legs, femora and tibia brown, tarsi, pale yellow. Abdominal tergites sepia-brown, dorsal stigmata pale brown; sternites brown, paler in mid-line, ventral stigmata also brown; cerci yellowish white.

Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by half to two-thirds own least diameter; postclypeus medium-sized to large and moderately inflated, Pcl/W, 0·20–0·30, hind margin evenly rounded, median suture distinct.

Pilosity of head capsule somewhat uneven with many long setae, not quite forming a pelt, brown.

Measurements (23 specimens from 14 localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	0·71–0·96	0·872 ± 0·063
Ocellus ($O_w \times O_l$)	0·06–0·09 × 0·08–0·12	0·072 ± 0·007 × 0·095 ± 0·010
Ocellus to eye (O–E)	0·03–0·06	0·044 ± 0·009
Postclypeus length (Pcl)	0·18–0·25	0·222 ± 0·021
Antennal article III	0·01–0·03	0·015 ± 0·004
Antennal article IV	0·03–0·05	0·032 ± 0·006
Antennal article V	0·02–0·04	0·030 ± 0·006
Left mandible, apical to first marginal (L_A)	0·05–0·08	0·067 ± 0·009
Left mandible, first to third marginal (L_l)	0·09–0·15	0·131 ± 0·016
Left mandible, third marginal to molar (L_m)	0·05–0·07	0·061 ± 0·006
Right mandible, apical to first marginal (R_A)	0·05–0·08	0·073 ± 0·009
Right mandible, first to second marginal (R_l)	0·07–0·10	0·091 ± 0·010
Right mandible, second marginal to molar (R_m)	0·05–0·08	0·065 ± 0·007
Mesonotum width (M)	0·13–0·21	0·176 ± 0·024
Metanotum width (N)	0·14–0·21	0·182 ± 0·020

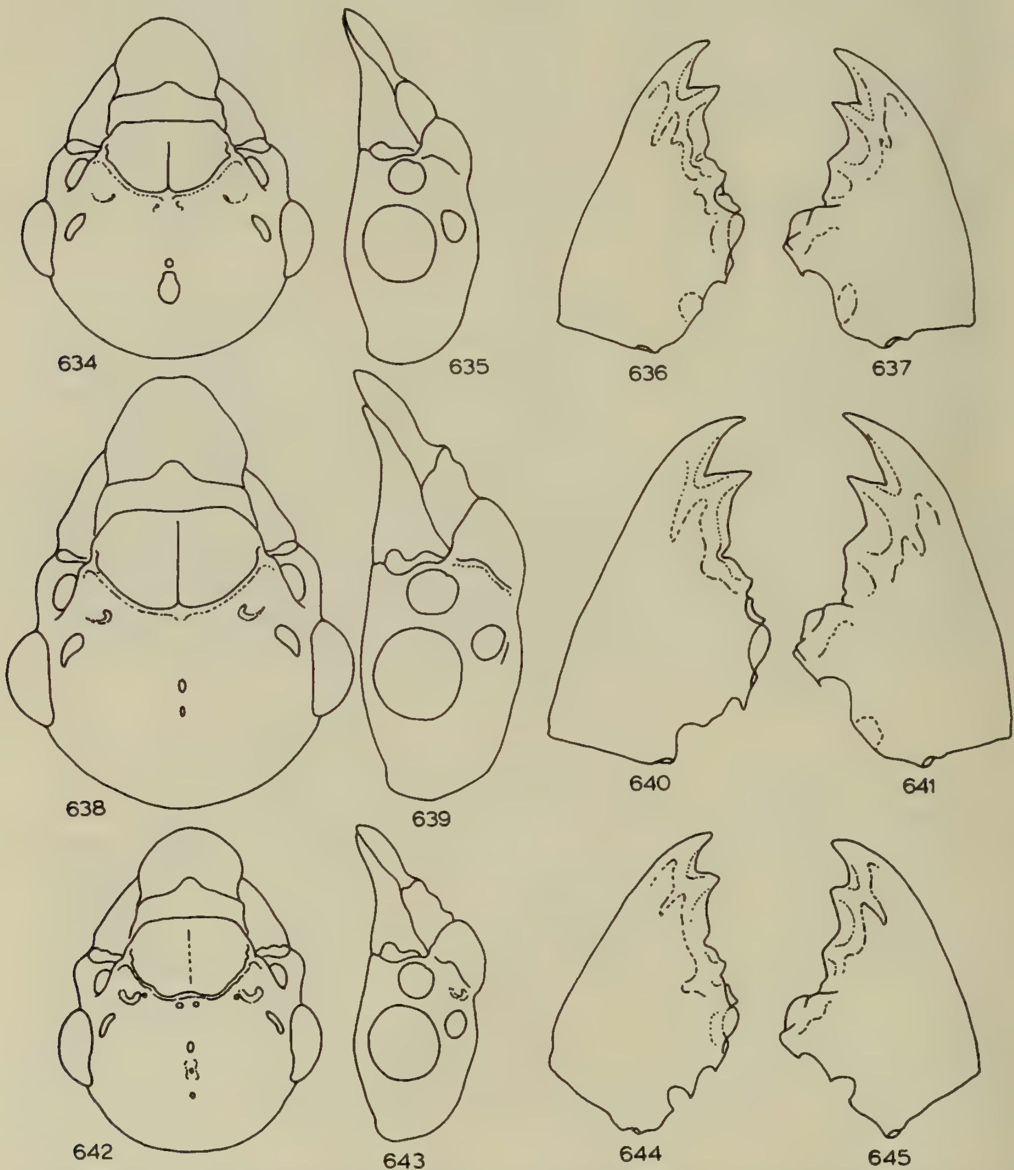
Worker. Head capsule white, pilosity short and fine, pale yellow. Postclypeus moderately inflated, Pcl/R_l, 2·50–3·40, Pcl/W, 0·27–0·34; left mandible with proximal end of subsidiary marginal tooth just clear of molar prominence. Fore tibia inflated, T_l/T_w, 3·54–4·00. Mixed segment of gut very long, length 7–8 times width of mesenteron at insertion of malpighian tubules; enteric valve seating a sessile circular rim on second pouch of proctodeum, completely hidden under folds of rectum in dorsal view of abdomen; internal cushions smooth with no trace of scales or reticulations, membrane beyond cushions with vestigial spicules.

Measurements (nine specimens from nine localities) in millimetres.

	Range	Mean ± S.D.
Head width (W)	0·59–0·73	0·627 ± 0·049
Fore tibia width (T_w)	0·12–0·14	0·129 ± 0·006
Fore tibia length (T_l)	0·44–0·53	0·488 ± 0·027
Postclypeus length (Pcl)	0·18–0·24	0·202 ± 0·021
Left mandible, apical to first marginal (L_A)	0·05–0·07	0·059 ± 0·007
Left mandible, first to third marginal (L_l)	0·09–0·11	0·102 ± 0·007
Left mandible, third marginal to molar (L_m)	0·04–0·05	0·044 ± 0·004
Right mandible, apical to first marginal (R_A)	0·04–0·07	0·059 ± 0·008
Right mandible, first to second marginal (R_l)	0·06–0·08	0·067 ± 0·005
Right mandible, second marginal to molar (R_m)	0·04–0·06	0·048 ± 0·005

Adaiphrotermes choanensis shows a remarkable degree of variation in the imago caste, such that it was at first divided into two species. However, intermediates between the forms were found and it became clear that the differences were associated with collections made in different years. It happened that the greater part of the material available for study was collected in batches of a number of nest-series from various localities in the years 1955, 1959, 1960 and 1962. There was a steady increase in size from the earlier to the later collections, coupled with an enlarging

fontanelle increasingly contrasting in colour with the darkening head, and progressing from depressed to protruding. At the same time the compound eyes remained relatively static, so that the head appeared more broadly rounded behind them, and they appeared to protrude less. Thus the species seemed to be evolving rapidly, until specimens collected in 1939 were examined and found to resemble the



FIGS 634–645. *Adaiphrotermes*, imago head capsule, front and side views, and imago mandibles. 634–637, *A. choanensis*; 638–641, *A. cuniculator*; 642–645, *A. scapheutes* (mandibles worn).

later form. The only explanation that suggests itself is that of climatic fluctuations affecting the food supply. The smaller, paler coloured specimens with a flat or depressed fontanelle might occur in adverse conditions that recur from time to time. The 'typical' form is therefore likely to be the larger, darker version with a conspicuous raised fontanelle that separates it clearly from *Adaiphrotermes cuniculator* and *Adaiphrotermes scapheutes*. In the worker caste, the fore tibia is slightly less inflated, but the gut characters appear to be more specialized (cf. section on phylogeny).

That *A. choanensis* belonged to the soldierless termites was first recognized by Dr A. E. Emerson, who labelled the syntypes as *Anoplotermes*, thereby ensuring their inclusion here. The species was placed in the genus *Procubitermes* Silvestri by Snyder (1949 : 167). It should be noted that Fuller associated a soldier of the genus *Lepidotermes* with the alates described under the name *Microtermes* (*Procubitermes*) *choanensis*, and the same vial, that is, the syntype series, included an imago of a species of *Astalotermes*. These specimens have been separated from the lectotype and paralectotypes of *A. choanensis*. The single soldier of *Lepidotermes* is not named here as this would require comparative studies of existing species, to one of which it may well belong.

A lectotype is designated below from the existing syntype material.

Type-material. *Mirotermes* (*Procubitermes*) *choanensis* Fuller, LECTOTYPE ♀ imago and paralectotype ♂ imagos from type-colony, REPUBLIC OF SOUTH AFRICA: Transvaal, Pretoria, Arcadia, 23.xi.1914 (*C. Fuller*), in National Collection of Isoptera, Pretoria; other paralectotypes from same colony in AMNH.

Other material. TANZANIA: Amani, Lewe, 14.iii.1951 (*P. B. Kemp*). MALAWI: Fort Lister Gap, 15°49'S., 35°51'E., 21.viii.1953 (*W. A. Sands & W. Wilkinson*). RHODESIA: Rekomitjie, 16°07'S., 29°24'E., 22.xi.1964 (two vials), Matopos, 20°25'S., 28°30'E., 17.xi.1965 and 22.xi.1965 (two vials) (*M. G. Bingham*). SWAZILAND: Stegi, 24.x.1960 (*J. L. Sheasby*); Hlatikulu, 25.x.1960 (*W. G. H. Coaton*), N.C.I. REPUBLIC OF SOUTH AFRICA: Transvaal, Pretoria, 27.x.1939 (three vials), Piet Retief, 7.xii.1959, Middleburg, 28.x.1960 (*W. G. H. Coaton*), N.C.I. and BMNH; Pretoria, 6.xi.1914 (*C. Fuller*), N.C.I. and AMNH; Natal, Zululand, Eshowe, 22.iv.1926 (*R. E. Turner*); Ubombo, 18.xi and 19.xi.1955 (five vials), Ingwavuma, 22.xi and 23.xi.1955 (three vials), Lower Tugela, 28.x.1957 (three vials), Ubombo, 8.xii and 18.xii.1959 (two vials), Ingwavuma, 14.xii.1959 (two vials) (*W. G. H. Coaton*), BMNH and N.C.I.; Ngotshe, 5.xii.1959, Vryheid, 5.xii.1959, Babanango, 6.xii.1959 (*P. C. Joubert*); Vryheid, 9.i.1962, Ubombo, 11.i.1962, Hlabisa, 11.i.1962, Entonjaneni, 13.i.1962 (*J. L. Sheasby*) BMNH and N.C.I.

Thirty-nine nest-series were examined, and the material is in the British Museum (Natural History) unless otherwise stated. In spite of the number of records available, nothing is known of the biology of this species.

Adaiphrotermes cuniculator **sp. n.**

(Text-figs 638–641 & 651–655; Pl. 9, fig. 11)

Imago. Head capsule dark sepia-brown, darker above ocelli; fontanelle small or vestigial, circular, slightly depressed, from distinct and pale coloured to obscure, coloured as head;

medial spot, dark sepia-brown, oval, flat, equal in size or larger than fontanelle; postclypeus sepia-brown, labrum yellow-brown; frontal marks indistinct, flat, coloured as head; antennae, pale brown, pronotum, sepia-brown, meso- and metanota pale brown, without dark sutures; legs, femora and tibiae pale brown, tarsi, yellowish-white. Abdominal tergites, sepia-brown, dorsal stigmata yellowish white; sternites, brown laterally, very pale brown in middle, ventral stigmata, as dorsal, cerci, yellowish white.

Posterior margin of head capsule slightly unevenly rounded; ocelli medium-sized, separated from compound eyes by about two-thirds own least diameter; postclypeus large and moderately inflated, Pcl/W index, 0·25–0·30, hind margin evenly rounded, median suture distinct.

Pilosity of head capsule uneven with many long setae, not forming a pelt, brown.

Measurements (13 specimens from seven localities) in millimetres.

	Range	Mean ± S.D.
Head width across eyes (W)	0·84–1·01	0·922 ± 0·061
Ocellus ($O_w \times O_l$)	0·06–0·09 × 0·09–0·13	0·076 ± 0·011 × 0·101 ± 0·012
Ocellus to eye (O–E)	0·04–0·06	0·052 ± 0·006
Postclypeus length (Pcl)	0·21–0·30	0·264 ± 0·028
Antennal article III	0·01–0·03	0·017 ± 0·004
Antennal article IV	0·04–0·05	0·042 ± 0·003
Antennal article V	0·03–0·04	0·039 ± 0·003
Left mandible, apical to first marginal (L_A)	0·06–0·10	0·079 ± 0·012
Left mandible, first to third marginal (L_l)	0·14–0·17	0·157 ± 0·012
Left mandible, third marginal to molar (L_m)	0·06–0·08	0·072 ± 0·007
Right mandible, apical to first marginal (R_A)	0·07–0·10	0·086 ± 0·011
Right mandible, first to second marginal (R_l)	0·01–0·13	0·110 ± 0·011
Right mandible, second marginal to molar (R_m)	0·06–0·08	0·074 ± 0·005
Mesonotum width (M)	0·14–0·19	0·162 ± 0·016
Metanotum width (N)	0·15–0·22	0·183 ± 0·022

Worker. Head capsule yellowish white, setae fine short, yellow. Postclypeus moderately inflated, Pcl/R_l, 2·14–2·94. Pcl/W, 0·27–0·34; left mandible with proximal end of subsidiary marginal tooth just clear of molar prominence. Fore tibia strongly inflated, T_l/T_w, 3·33–3·70. Mixed segment of gut length 3–4 times width of mesenteron at insertion of malpighian tubules; enteric valve seating sessile on second pouch of proctodeum, weakly three lobed; internal cushions, proximally weakly scaly, distally reticulated, sometimes with very small marginal points; membrane beyond cushions with sparse rows of minute spicules.

Measurements (six specimens from six localities) in millimetres.

	Range	Mean ± S.D.
Head width (W)	0·69–0·75	0·729 ± 0·022
Fore tibia width (T_w)	0·14–0·15	0·149 ± 0·003
Fore tibia length (T_l)	0·50–0·53	0·514 ± 0·013
Postclypeus length (Pcl)	0·19–0·25	0·231 ± 0·023
Left mandible, apical to first marginal (L_A)	0·06–0·08	0·070 ± 0·006
Left mandible, first to third marginal (L_l)	0·11–0·13	0·120 ± 0·005
Left mandible, third marginal to molar (L_m)	—	0·051 ± 0·002
Right mandible, apical to first marginal (R_A)	0·06–0·08	0·071 ± 0·006
Right mandible, first to second marginal (R_l)	—	0·088 ± 0·003
Right mandible, second marginal to molar (R_m)	—	0·050 ± 0·002

A. cuniculator is usually distinguishable from *A. choanensis* in the imago by the less conspicuous fontanelle and flat medial spot. In the worker caste, the much shorter mixed segment of the gut is the most characteristic feature. In the other species, *A. scapheutes*, the imago postclypeus has a sinuate hind margin, and the fontanelle is practically obsolete. The worker has a long mixed segment like *A. choanensis* but the enteric valve seating has a short neck and three definite lobes, the postclypeus is less inflated, and the fore tibia more so.

Holotype ♀ imago, paratype ♂ and ♀ imagos, and workers from type-colony, GHANA: 40 m. from Tumu on Lawra Road, 16.iii.1959 (*W. A. Sands*, Coll. No. S.2458), in British Museum (Natural History).

Other paratype material. GHANA: 60 m. north of Ejura on Tamale Road, three nest-series, 24.ii.1959, 55 m. from Tamale on Damongo Road, 3.iii.1959, 35 m. from Tamale on Yendi Road, two nest-series, 4.iii.1959, 40 m. from Tumu on Lawra Road, 16.iii.1959, 6 m. north of Wa on Lawra Road, 19.iii.1959, 52 m. south of Wa on Sawla Road, 20.iii.1959, 19 m. from Sawla on Damongo Road, 21.iii.1959, 12 m. from Damongo on Tamale Road, 24.iii.1959 (*W. A. Sands*); Aburi, 1926 (*W. H. Patterson*); Kumasi, 3.ii.1955 (*W. V. Harris*). GAMBIA: Abuko, 13°24′N., 16°39′W., 10.ix.1966, between Sanyang and Gunjur, 13°15′N., 16°46′W., 16.ix.1966, 35 m. from Bathurst on Manso Konko Road, 18.ix.1966 (*W. A. Sands*). NIGERIA: Mid-Western Region (Benin Province), Obanokoro, Sobo Plain, 8.i.1957 (*W. Wilkinson*); Northern Region, Samaru, near Zaria, 25.iv.1959 (*W. A. Sands*).

Nineteen nest-series of this species were examined and all the material is in the British Museum (Natural History).

Nearly all of the records are from the surface layers of mounds of other termites, mostly those of *Macrotermes* or *Odontotermes* but with a few others such as *Cubitermes* and *Trinervitermes*. It appears to be a savanna species with a fairly wide distribution in West Africa.

Adaiphrotermes scapheutes sp. n.

(Text-figs 642–645 & 656–661; Pl. 9, fig. 12)

Imago. Queen only known, colour therefore probably faded. Head capsule yellow-brown, brown above ocelli; fontanelle almost obsolete, minute, oval, flat, brown; medial spot larger than fontanelle, one-third diameter of ocellus, flat, yellow-brown; postclypeus pale yellow-brown, labrum yellow; frontal marks indistinct flat crescents, pale yellow-brown; antennae yellow. Pronotum, meso- and metanota, pale yellow-brown, mesonotal suture absent, metanotal suture present; legs, femora and tibiae yellow, tarsi yellowish white. Abdominal tergites pale yellow-brown, dorsal stigmata darker, yellow-brown; sternites, laterally yellow, paler in middle, ventral stigmata pale yellow-brown, cerci yellowish white.

Posterior margin of head capsule evenly rounded; ocelli medium-sized, separated from compound eyes by two-thirds own least diameter; postclypeus larger and rather strongly inflated, Pcl/W index 0·32, hind margin sinuate, not evenly rounded, median suture weak.

Pilosity of head capsule uneven, not forming a pelt, yellow.

Measurements (one specimen) in millimetres.

Head width across eyes (W) . .	0·83
Ocellus ($O_w \times O_l$) . . .	0·07 × 0·10

Ocellus to eye (O–E) . . .	0·04
Postclypeus length (Pcl) . .	0·27
Antennal article III . . .	0·02
Antennal article IV . . .	0·03
Antennal article V . . .	0·03
Left mandible, apical to first marginal (L_A)	0·06
Left mandible, first to third marginal (L_l)	0·14
Left mandible, third marginal to molar (L_m)	0·06
Right mandible, apical to first marginal (R_A)	0·07
Right mandible, first to second marginal (R_l)	0·09
Right mandible, second marginal to molar (R_m)	0·06
Mesonotum width (M) . . .	0·16
Metanotum width (N) . . .	0·16

Worker. Head capsule pale yellow, fine, short, rather numerous pilosity, yellow. Postclypeus rather weakly inflated, Pcl/R_l, 1·59, Pcl/W, 0·21; left mandible with proximal end of subsidiary marginal tooth separated from molar prominence by pronounced notch. Fore tibia strongly inflated, T_l/T_w, 3·08. Mixed segment of gut long, length 5–6 times width of mesenteron at insertion of malpighian tubules; enteric valve seating with three distinct equal lobes, and a short neck connecting it to second pouch of proctodeum; internal cushions entirely reticulated, membrane beyond cushions with vestigial spicules.

Measurements (one specimen) in millimetres.

Head width (W)	0·66
Fore tibia width (T_w)	0·16
Fore tibia length (T_l)	0·48
Postclypeus length (Pcl) . . .	0·14
Left mandible, apical to first marginal (L_A)	0·05
Left mandible, first to third marginal (L_l) .	0·11
Left mandible, third marginal to molar (L_m)	0·05
Right mandible, apical to first marginal (R_A)	0·06
Right mandible, first to second marginal (R_l)	0·09
Right mandible, second marginal to molar (R_m)	0·05

Adaiphrotermes scapheutes may be expected to overlap in its distribution with *A. choanensis*, from which it differs in the imago by the sinuate posterior margin of the postclypeus and the inconspicuous fontanelle. The worker mandible differs, and the fore tibia is more strongly inflated. Comparison with *Adaiphrotermes cuniculator* is made in the discussion on that species.

Holotype ♀, imago (queen) and three paratype workers from type-colony only, ZAMBIA: Kitwe, 23.i.1957 (*W. G. H. Coaton*) in National Collection of Isoptera, No. TM.3928, Pretoria.

Only the type-nest-series of this species is known. There is no information on its biology.

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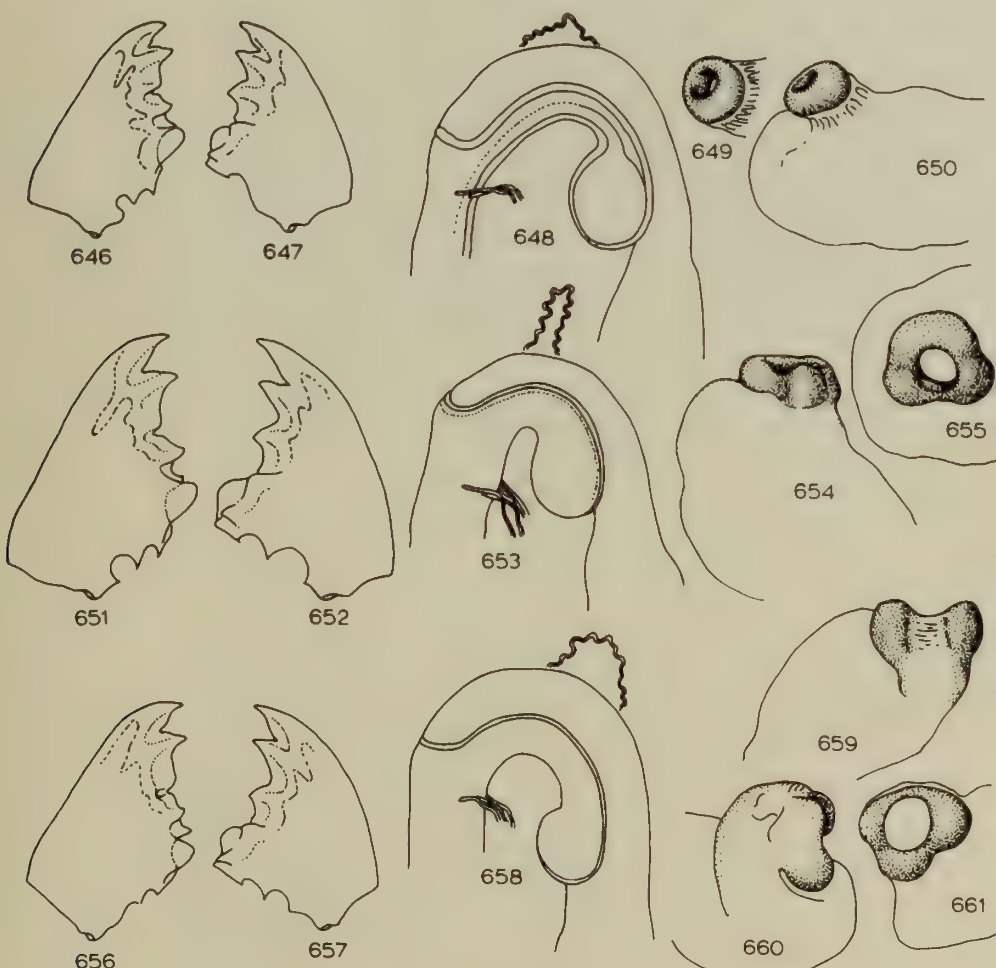
This work could not have been accomplished without generous help from a number of persons and institutions, and to all of these I owe sincere gratitude.

Firstly I particularly wish to thank Dr A. E. Emerson for access to his unique collection, now housed at the AMNH, and for much valuable information on species which would otherwise have been left out of this revision. There can be few specialists on the Isoptera who have not benefited from his wide experience of the group and I am glad to acknowledge my own debt. Dr Kumar Krishna of the



FIGS 646–661. *Adaiphrotermes*, worker mandibles, mesenteric-proctodeal junctions showing attachments of malpighian tubules and positions of malpighian knot, and views of enteric valve seatings. 646–650, *A. choanensis*; 651–655, *A. cuniculator*; 656–661, *A. scapheutes*.

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APPENDIX

Acholotermes socialis (Sjöstedt) **comb. n.**

Eutermes socialis Sjöstedt, 1899 : 38. LECTOTYPE ♀ imago, CAMEROUN: Mungo River (Naturhistoriska Riksmuseum, Stockholm), here designated [examined].

This species is catalogued in the genus *Pericapritermes* by Snyder (1949). Silvestri (1914) transferred it to *Anoplotermes* on the basis of specimens other than the type-series. Sjöstedt (1926) placed it in *Pericapritermes*, where it has remained, with the name in common use for a well known West African species. Emerson examined the remaining specimen of the type-series in the Sjöstedt collection in 1952 and labelled it as the lectotype of *Anoplotermes socialis* (Sjöstedt) but the designation has not been published until now.

This specimen was not examined until after the completion of the present work and too late for inclusion in the key to *Acholotermes*, to which it is now assigned. It agrees with *Acholotermes chirotus* in most of its measurements and complex ratios, and runs down to that species in the key. However, it differs in having a slightly longer postclypeus, a more elongate oval fontanelle, and larger ocelli. The lectotype specimen of *A. socialis* is broken into several pieces, the compound eyes are collapsed, and it is much faded from long preservation, adding to the difficulties of comparison. The more important worker caste is not available. In view of its poor condition, and the wide separation of the type-localities of the two species (1300

miles), it is inadvisable to synonymise *A. chirotus* with *A. socialis*. They may in future be proved synonymous by additional material from intermediate localities.

The specimen labelled as lectotype by Emerson in 1952 is so designated, as follows:-

Eutermes socialis Sjöstedt, LECTOTYPE ♀ imago, CAMEROUN: Mungo River, ix. 1874 (*R. Bucholz*), in Naturhistoriska Riksmuseum, Stockholm. (Sjöstedt reported also depositing specimens at Mus. Greifswald, E. Germany, but these have not been examined.)

The records of the species of *Pericapritermes* hitherto known as *P. socialis* are therefore misidentifications for which it is desirable to provide an alternative name. All the material identified as *P. socialis* at the BMNH has been compared with Sjöstedt's specimen of the soldier from CAMEROUN: Mungo River, x. 1874 (*R. Bucholz*) (Sjöstedt collection No. 931) and found to be the same species. This is the only species known from the forest areas around Lagos and Ibadan. Silvestri (1914) described *Pericapritermes urgens* Silvestri 'var. nov.' *nigeriana* as being smaller than the typical form. His localities were forests near Lagos, Olokemeji, and Ibadan. It is clear from his use of a geographical name that in this case his varietal concept should be construed as having subspecific rank. There is little doubt that this is the same species as that previously known as *P. socialis*, with which its description agrees in every particular. The name *nigeriana*, suitably emended, is available for the taxon, as set out below:-

Pericapritermes nigerianus Silvestri **stat. n.**

Pericapritermes urgens Silvestri var. *nigeriana* Silvestri, 1914 : 137. Syntype soldiers and workers, NIGERIA: Lagos, Olokemeji, Ibadan, in Silvestri Coll., Istituto Entomologia di Agraria, Naples.

All previously published uses of the erroneous combination *Pericapritermes socialis* (Sjöstedt) should now be referred to the above species name.

INDEX

(Junior synonyms are given in italics, species belonging to other groups in brackets).

W. A. Sands, M.Sc., A.R.C.S., D.I.C., M.I.Biol.
Centre for Overseas Pest Research
c/o British Museum (Natural History)
Cromwell Road
London, SW7 5BD

PLATE 1

Enteric valve armature. Some valves are mounted whole, others slit and opened out. Small 'p' in lower right corner indicates use of phase contrast illumination.

FIGS 1, *Acidnotermes praus*; 2, *Amalotermes phaeocephalus*; 3, *Astalotermes benignus*; 4, *Astalotermes amicus*; 5, *Astalotermes ignavus*; 6, *Astalotermes acholus*; 7, *Astalotermes brevior*; 8, *Astalotermes quietus*; 9, *Astalotermes empodius*; 10, *Astalotermes irrixosus*; 11, *Adynatotermes moretelae*.

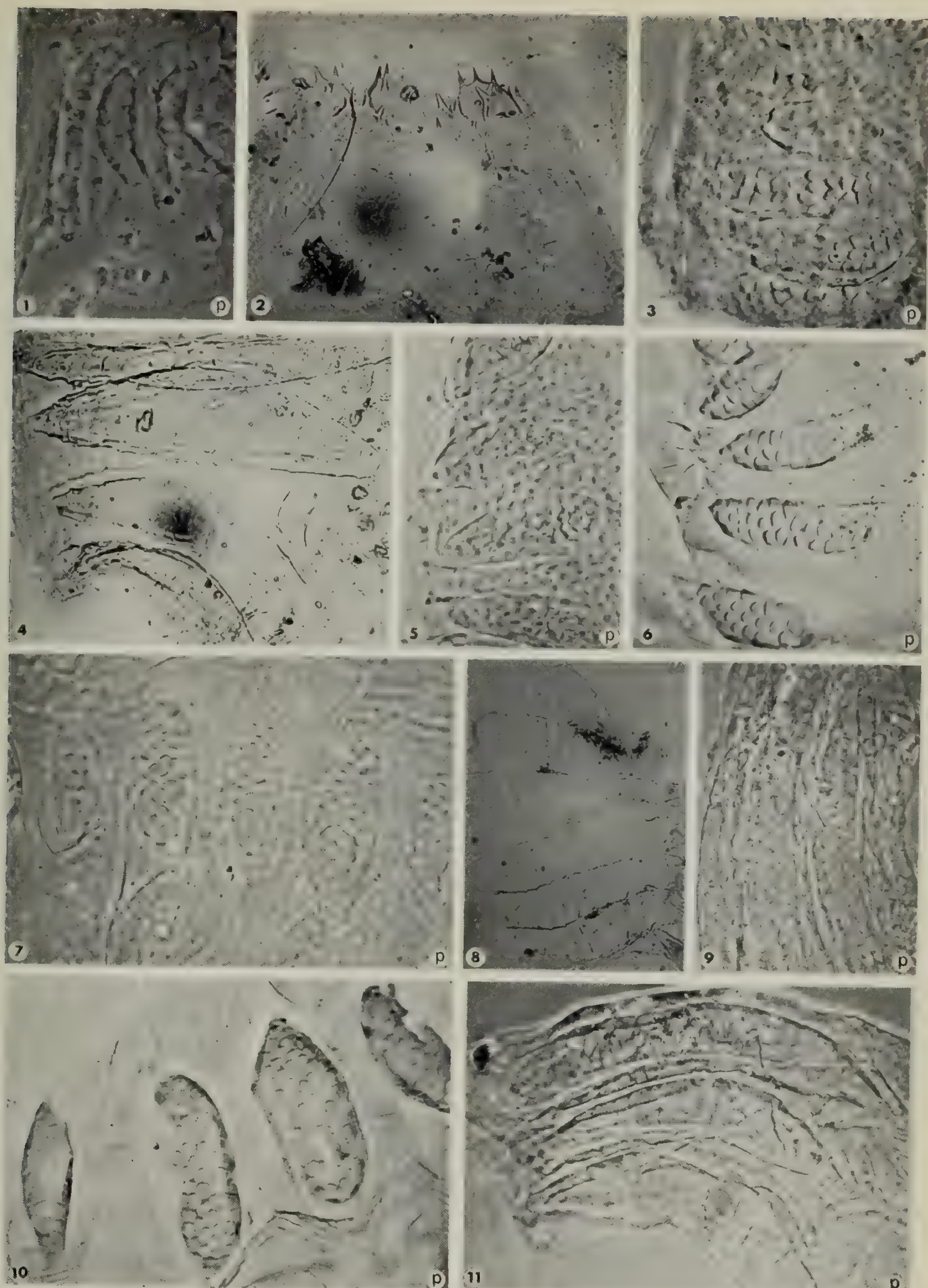

1
p
2
3
p
4
5
p
6
p
7
p
8
9
p
10
p
11
p

PLATE 2

Enteric valve armature. Some valves are mounted whole and viewed from side or end on, others slit and opened out. Small 'p' in lower right corner indicates use of phase contrast illumination.

FIGS 1, *Astratotermes aneristus*; 2, *Astratotermes hilarus*; 3, *Astratotermes pacatus*; 4, *Astratotermes mansuetus*; 5, *Astratotermes prosenus*; 6 & 7, *Alyscotermes trestus*; 8–11, *Alyscotermes kilimandjaricus*; 12, *Aganotermes oryctes*.


1 p
2 p
3
4 p
5 p
6
7
12 p
8
9
10
11

PLATE 3

Enteric valve armature. Some valves are mounted whole and viewed from side or end on, others slit and opened out. Small 'p' in lower right corner indicates use of phase contrast illumination.

FIGS 1 & 2 (latter enlarged), *Acholotermes chirotus*; 3, *Acholotermes epius*; 4, *Acholotermes imbellis*; 5 & 6, *Acholotermes tithasus*; 7–10, *Amicotermes galenus* (10, one cushion enlarged).

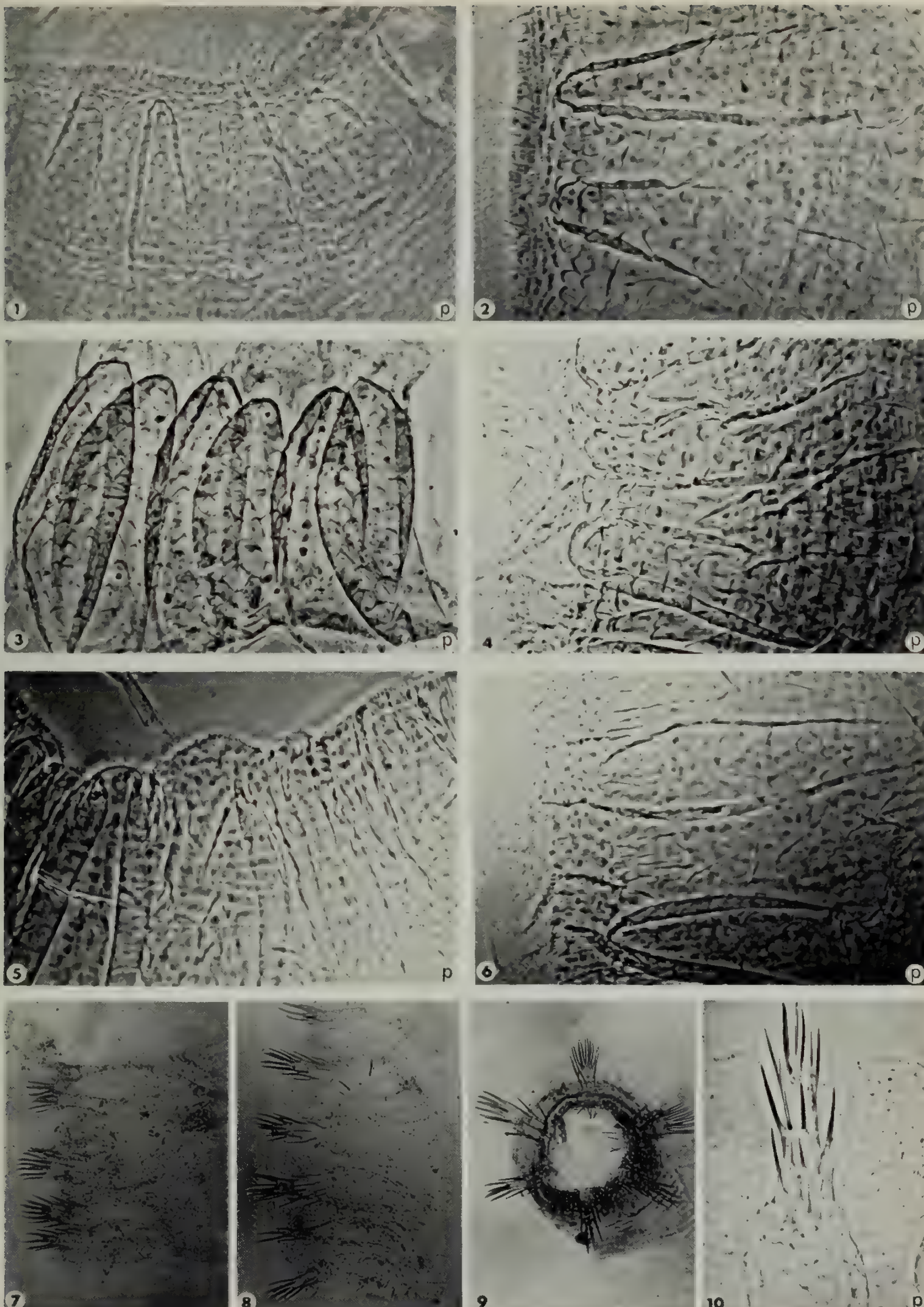

1 p
2 p
3 p
4 p
5 p
6 p
7
8
9
10 p

PLATE 4

Enteric valve armature. Some valves are mounted whole and viewed from side or end on, others slit and opened out.

FIGS 1 & 2, *Apagotermes stolidus*; 3 & 4, '*Ateuchotermes*' undescribed species with all cushions equally developed; 5, *Ateuchotermes tranquillus*; 6 & 7, *Ateuchotermes pectinatus*.

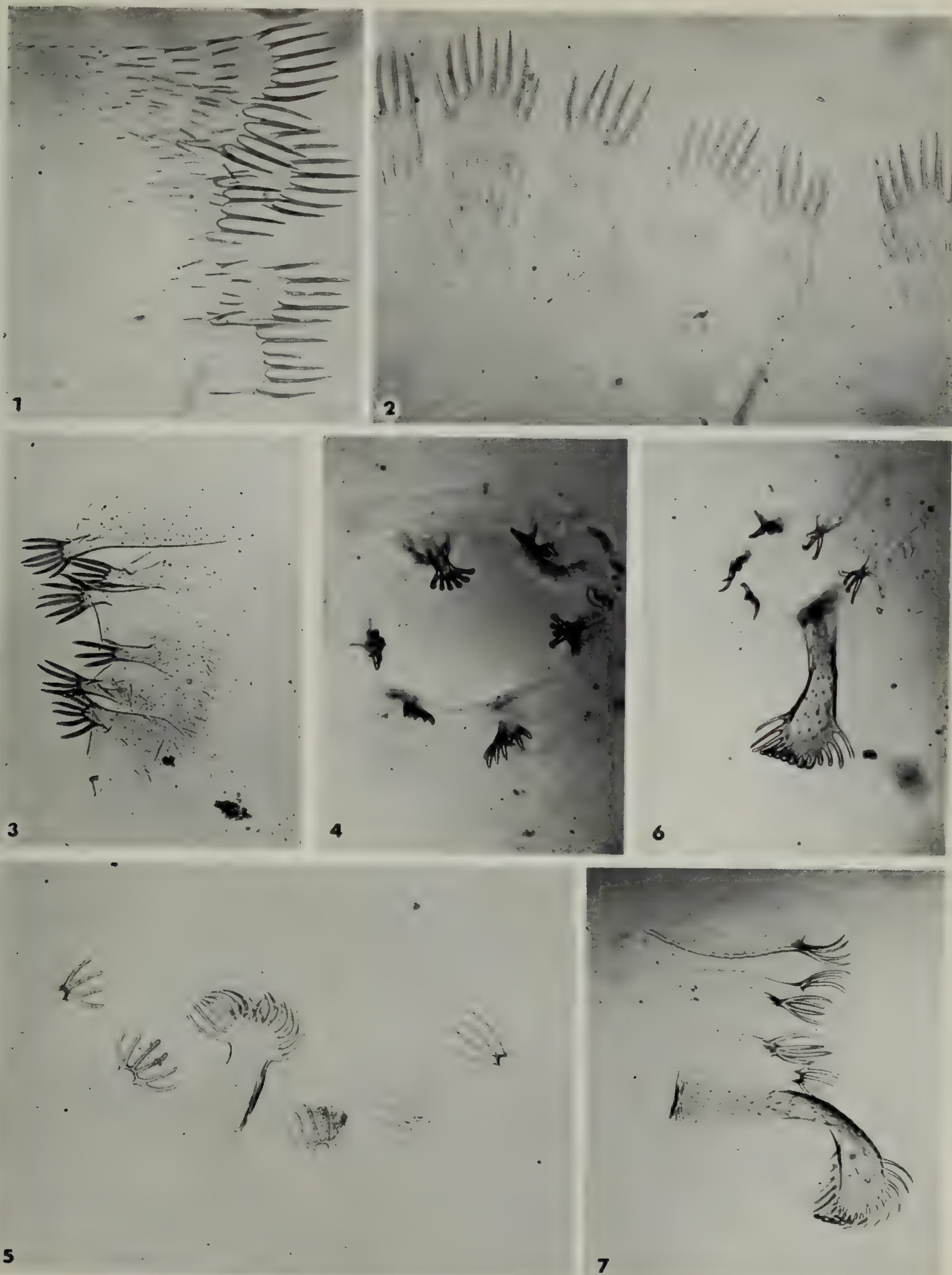

1
2
3
4
6
5
7

PLATE 5

Enteric valve armature. Valves are mounted whole and viewed from side or end on.
FIGS 1–3, *Ateuchotermes rastratus*; 4–6, *Ateuchotermes muricatus*; 7–9, *Ateuchotermes sentosus*.

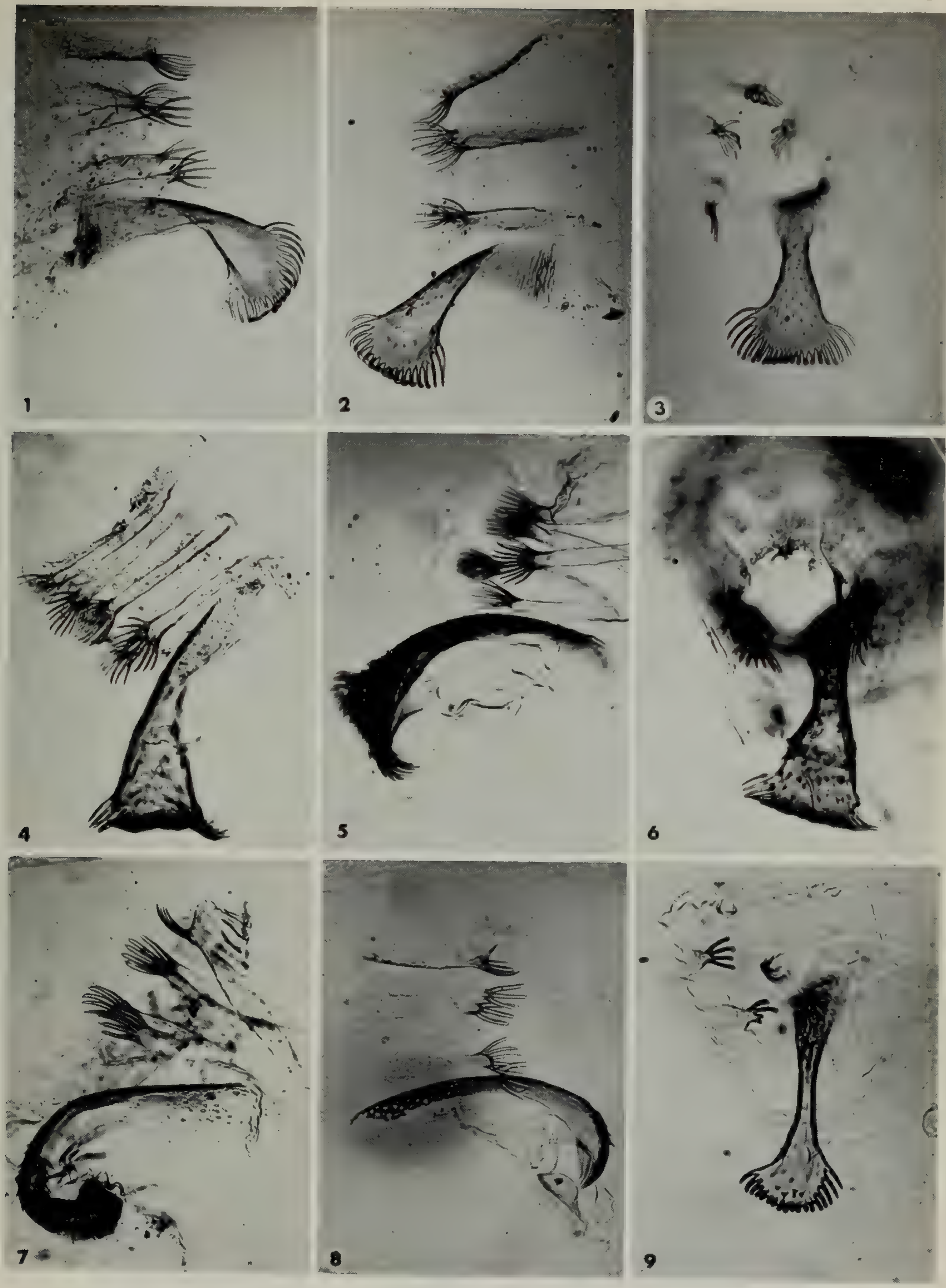

1
2
3
4
5
6
7
8
9

PLATE 6

Enteric valve armature. Some valves are mounted whole and viewed from side or end on, others slit and opened out.

Figs 1 & 2, *Ateuchotermes ctenopher*; 3–5, *Ateuchotermes spinulatus*; 6–8, *Ateuchotermes retifaciens* (8, some of spines enlarged to show interlocking of hooked tips to form 'network').

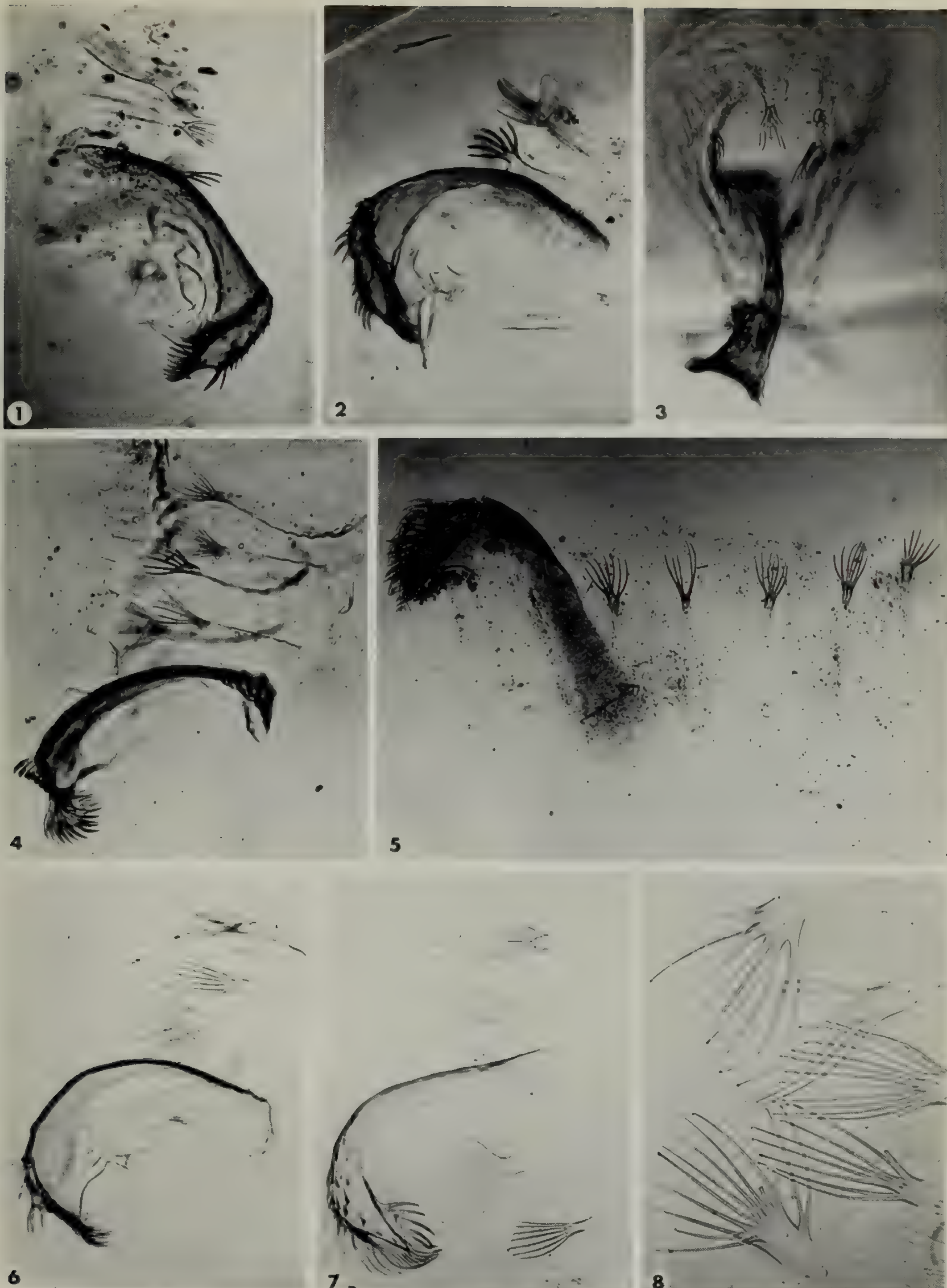

1
2
3
4
5
6
7
8

PLATE 7

Enteric valve armature. Some valves are mounted whole and viewed from side or end on, others slit and opened out. Small 'p' in lower right corner indicates use of phase contrast illumination.

FIGS 1–3, *Anaorotermes echinocolon*; 4 & 5, *Asagarotermes coronatus* (5, end view enlarged); 6, *Anenteotermes ateuchestes*; 7, *Anenteotermes disluctans*; 8, *Anenteotermes hemerus*.

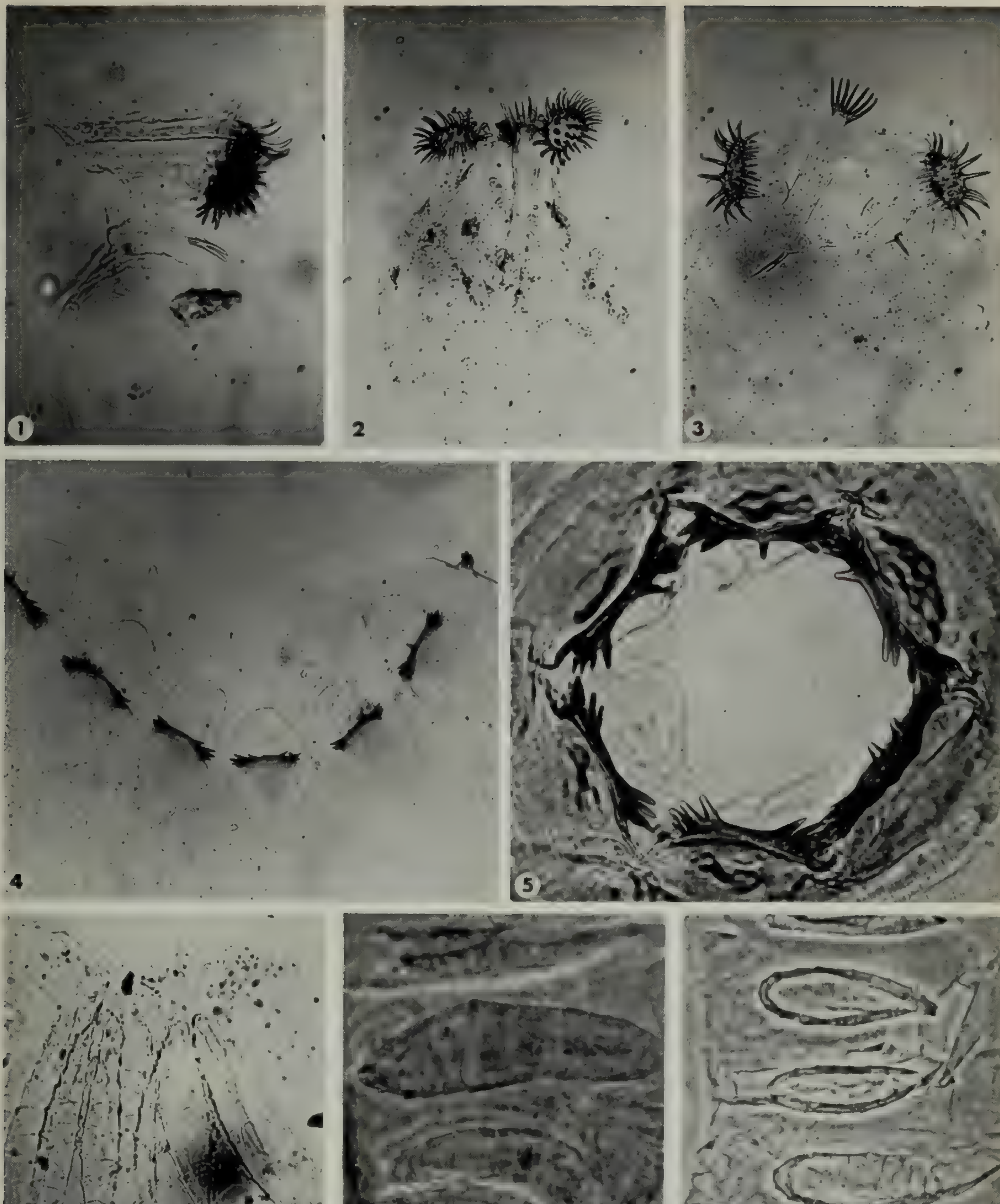

1
2
3
4
5
6
7
p
8
p

PLATE 8

Enteric valve armature. Some valves are mounted whole and viewed from side, others slit and opened out. Small 'p' in lower right corner indicates use of phase contrast illumination

FIGS 1, *Anenteotermes amachetus*; 2, *Anenteotermes nanus*; 3, *Anenteotermes cnaphorus*; 4–6, *Anenteotermes polyscolus*.

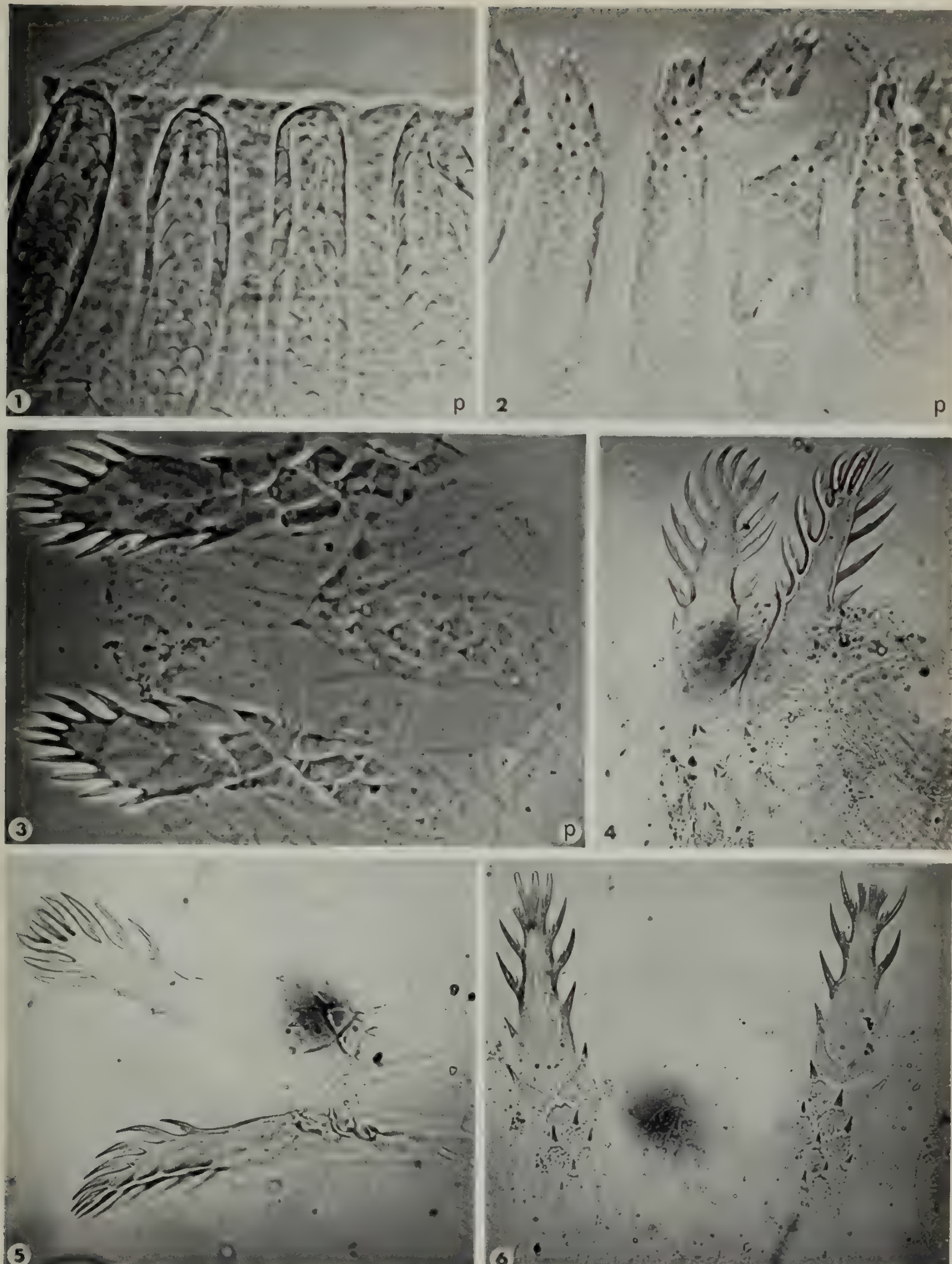
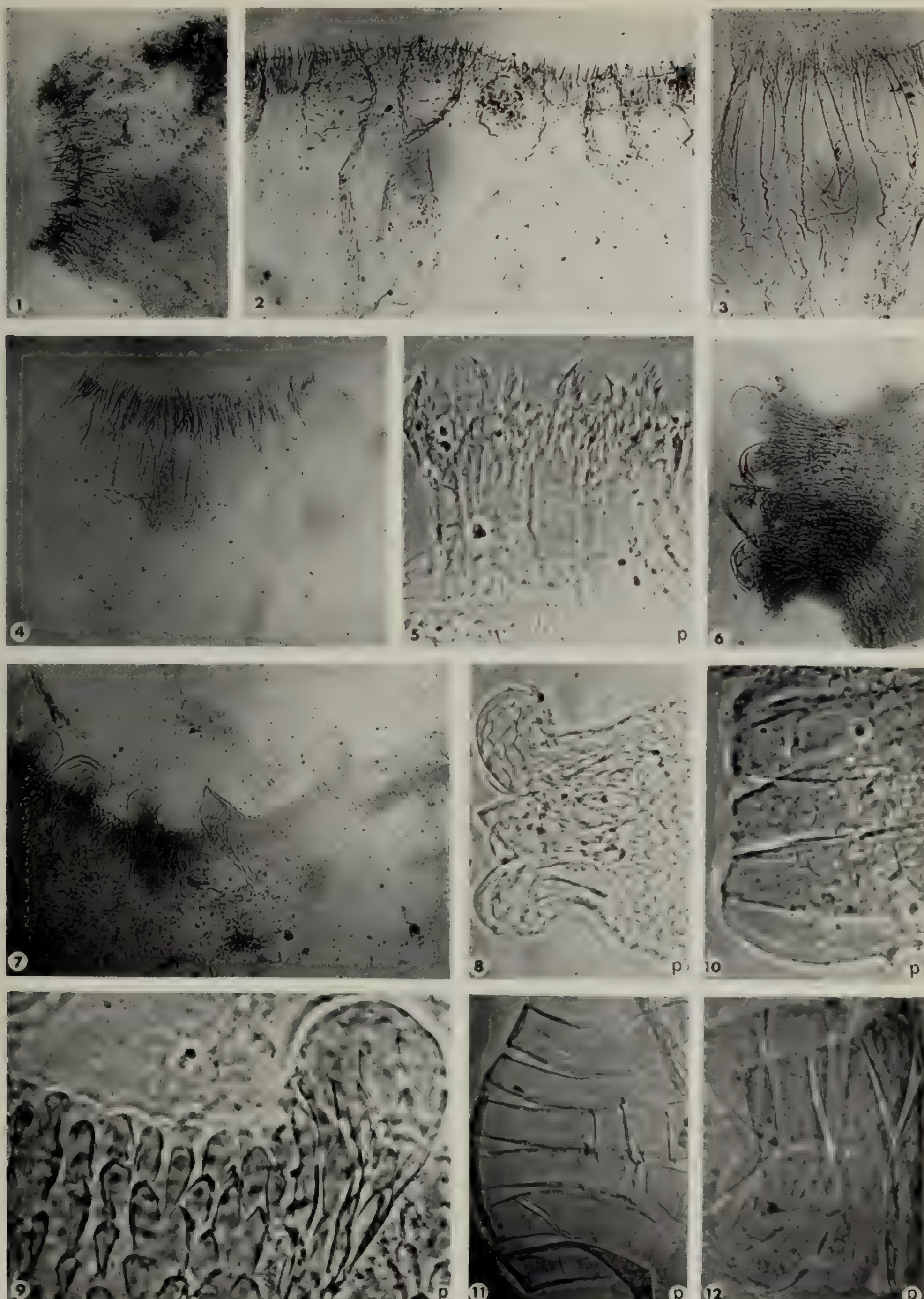

1
p
2
p
3
p
4
5
6

PLATE 9

Enteric valve armature. Some valves are mounted whole and viewed from side, others slit and opened out. Small 'p' in lower right corner indicates use of phase contrast illumination.

FIGS 1–4, *Aderitotermes fossor*; 5, *Aderitotermes* unnamed species from W. Africa exactly intermediate between two named spp.; 6 9, *Aderitotermes cavator* (9, single cushion and part of wall enlarged); 10, *Adaiphrotermes choanensis*; 11, *Adaiphrotermes cuniculator*; 12, *Adaiphrotermes scapheutes*.



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